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ILLINOIS ENVIRONMENTAL PROTECTION AGENCY
DIVISION OF WATER POLLUTION CONTROL
2200 CHURCHILL ROAD
SPRINGFIELD, ILLINOIS 62706



1981 VOLUNTEER LAKE MONITORING PROGRAM REPORT



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1981 VOLUNTEER LAKE MONITORING PROGRAM REPORT
FOR
BORAH LAKE, RICHLAND COUNTY, ILLINOIS

A Cooperative Citizen-
Illinois Environmental Protection Agency
Project

May, 1982
Illinois Environmental Protection Agency
2200 Churchill Road
Springfield, Illinois 62706

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This is one of 87 reports prepared for lakes in the 1981 Volunteer Lake Monitoring Program. It represents the coordinated effort of many individuals.

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Program coordination was provided by Donna Sefton for the Illinois EPA's Ambient Monitoring Unit and Carol Beim for the Public Participation Section.

Volunteers were trained by Public Participation Coordinators Carol Beim, Bob Hagele, William Hammel, Patrick McCarthy, Vanessa Musgrave, and Dawn Wrobel. Lake maps were prepared by J. W. Hammel and Bob Hagele. Lake assessment summaries were prepared by Patrick McCarthy.

Assessment and monitoring information was provided by approximately 140 volunteers throughout the state.

Data handling was performed by John Little, Jill Hardin, Marilyn Budd, Lori Whalen, Cora Stockton, and Karen Janssen. Data analyses were performed and tabular and graphical outputs obtained by John Little using programs developed for the Tektronix desk top computer terminal by Dr. David J. Schaeffer and Vladimir Chernomordikov.

Donna Sefton, Howard Essig, John Little, John Lesnak, Carol Beim, and Bob Hagele wrote portions of the lake reports. Reports were edited by Planning Section and Public Participation staff, particularly Marilyn Budd and Mary Anderson. The contributions of Robert Clarke and Thomas Davenport are recognized.

Reports were typed by Word Processing under the direction of Norma Kraus and Diane Woodyard while Field Observations and Lake Assessment Summaries were typed by Betty Pennington, Lori Whalen, Karen Janssen, and Marilyn Budd.

INTRODUCTION

A cooperative volunteer lake monitoring effort was initiated by the Illinois EPA in 1981 as part of a self-help service program being developed for lakes. In addition to expanding the Agency's lakes data base with information on present water quality and trends, the program was designed to involve citizens in learning about a lake so they could make more informed decisions regarding its use, protection, and enhancement.

Citizens selected a lake they were concerned about and were trained to measure water clarity or transparency by recording the depth to which a Secchi disc (an eight-inch diameter metal plate painted black and white in alternating quadrants) was visible. They also measured total depth and recorded field observations from a boat at three sites on their chosen lake. Readings were to be taken twice a month from May through October and reported to the Agency on special data forms. The Secchi disc, data forms, and postage paid envelopes were provided by the Agency. Volunteers were required to have a boat with an anchor to perform the monitoring.

Approximately 140 volunteers participated in monitoring 87 lakes in 1981. The sampling data were computerized to facilitate analyses and preparation of tables and graphs for reports. A statewide report entitled "Volunteer Lake Monitoring, 1981", summarized all the data for the volunteer lakes. Individual reports were also prepared for each of the 87 lakes monitored by volunteers in 1981.

BACKGROUND

Borah Lake is a 137 acre impoundment owned by the City of Olney in Richland County, Illinois. The lake, which was constructed by damming the East Fork of the Fox River in 1953, has a maximum depth of 32 feet, an average depth of 11 feet and a storage capacity of 1517 acre feet (Table 1).

Borah Lake serves as a potential potable water source in case East Fork Lake, the present supply, goes dry. It also serves as an agricultural water supply. Major recreational uses associated with the lake are fishing, swimming, powerboating, waterskiing and rowboating or canoeing. Although some of the shoreline is privately owned, there is a public beach and boat ramp which serves as a public access. A boat license is required.

The 2,154 acre watershed of Borah Lake is estimated to be comprised primarily of row crops, woodland, and residential areas. The lake shoreline is primarily woodland and cabins, with row crops behind them.

TABLE 1. LAKE ASSESSMENT SUMMARY, BORAH LAKE, RICHLAND COUNTY, ILLINOIS (RC-A09-B).

I. GENERAL INFORMATION

River Basin: Little Wabash
Segment: A09

Ownership: City of Olney

Surface Area (Acres): 137*
Watershed Area (Acres): 2,154 *
Maximum Depth (Feet): 32.0*
Average Depth (Feet): 11.0*
Storage Capacity (Acre/Feet): 1517*
Inflowing Stream(s): E. Fork of Fox River
Outflowing Stream(s): E. Fork of Fox River
Water Retention Time: 0.704 years
Lake Type: dammed stream
Year Constructed: 1953

II. USAGE

Public Access: yes

Lake Usage:

Potable Water Supply: slight
Industrial Water Supply: none
Agricultural Water Supply: light
Cooling Water: none
Recreation: moderately heavy
Fishing: heavy
Swimming: moderate
Power Boating: moderate
Row Boating or Canoeing: moderate
Sailboating: light
Camping: none
Picnicking: light
Waterfowl Hunting: none
Waterfowl Observation: light
Other:

Recreational Facilities:
beach, picnic area, boat launch

Shoreline Usage (Percent):

Urban (Including Streets):
Residential (Including Lawns): 50%
Golf Courses:
Pasture or Grassland:
Woodland: 30%
Row Crops:
Wetland:
Other: woods and cabins on shore and
row crops behind them.

Watershed Usage (Percent):

Urban:
Residential:
Golf Courses:
Pasture or Grassland:
Woodland:
Row Crops:
Wetland:
Other:

III. WATER QUALITY AND PROBLEMS

General Water Quality: good in Spring Poor in Aug.
Fishing: good

Conditions and Extent:

Suspended Sediment: slight
Deposition of Sediment: slight
Algal Blooms: moderate
Aquatic Weeds: moderate
Taste and/or Odor: moderate
Water Level Fluctuation: large
Fishkills: slight
Other:

IV. CAUSES OF WATER QUALITY PROBLEMS

Potential Pollution Sources:

Sewage Treatment Plant Effluent: yes
Industrial Discharge:
Urban Storm Drainage:
Septic Tanks: yes
Pasture or Grassland Runoff: yes
Cropland Runoff: yes
Feedlot Runoff:
Construction Site Runoff:
Fertilizer or Pesticides from
Lawns/Golf Courses:
Orchards: yes
Forestry Operations Runoff:
Mining:
Waterfowl: yes
Sediment in Lake: yes
Other: Shoreline erosion primarily due to boating

V. LAKE MANAGEMENT

Comments: _____

Information Supplied By Arthur O. Omland (1981); *Illinois State Water Survey, Sediment Survey (1960)

Water level fluctuation is considered a substantial problem for Borah Lake, while algal blooms, taste and odor, and aquatic weeds are considered moderate problems. Sewage treatment plant effluent, septic tanks, shoreline erosion, waterfowl, sediment in the lake, and pasture, grassland, cropland, and orchard runoff are cited as potential pollution sources.

Assessment information on Borah Lake was provided by Arthur Omland and the Illinois State Water Survey. Monitoring was performed by Arthur Omland. Secchi disc transparency, total depth, and field observations were recorded at three sites (located in Fig. 1) on eight dates in 1981.

RESULTS AND DISCUSSION

In this section, monitoring results will be presented for the lake and compared to those for other lakes in the volunteer program. Then spatial (within lake) and seasonal differences in transparency will be examined and related to field observations. Results will also be discussed in terms of lake uses. For an explanation of unfamiliar terms or concepts presented here, refer to the report "Volunteer Lake Monitoring, 1981", Section IV "Understanding Illinois' Lakes."

The Secchi monitoring data for Borah Lake are summarized in Table 2 and plotted in Figure 2. Total depth data are presented in Table 3, while field observations are summarized in Table 4.

Transparency of Borah Lake

The average Secchi disc transparency of Borah Lake was 81.8 inches, which ranked number 8 when the average transparencies of volunteer lakes were ranked from clearest (number 1 at 137.8 inches) to least transparent (number 87 at 7.3 inches). This average transparency was greater than the four feet minimum recommended for swimming by the Illinois Department of Public Health (1976) and was above average for Illinois lakes.

Spatial and Seasonal Differences in Transparency

The Secchi disc transparency of Borah Lake ranged from a maximum of 156 inches at Site 1 on May 12 to a minimum of 42 inches at Sites 2 and 3 on June 3.

Differences in clarity were evident in different sections of Borah Lake. Transparency averaged 89.3 inches, 77.3 inches, and 78.8 inches at Sites 1, 2, and 3, respectively. Readings at Site 1 were greater than or equal to the four feet minimum recommended for swimming on all sampling dates; while at Sites 2 and 3 they were less than four feet on June 3. The lower Secchi readings at Sites 2 and 3 were probably related in part to the shallower depth of these sites which allowed resuspension of bottom sediments by wind and wave activity. It may also reflect the input of nutrients and sediment in the vicinity.

FIGURE 1

BORAH LAKE

RICHLAND COUNTY

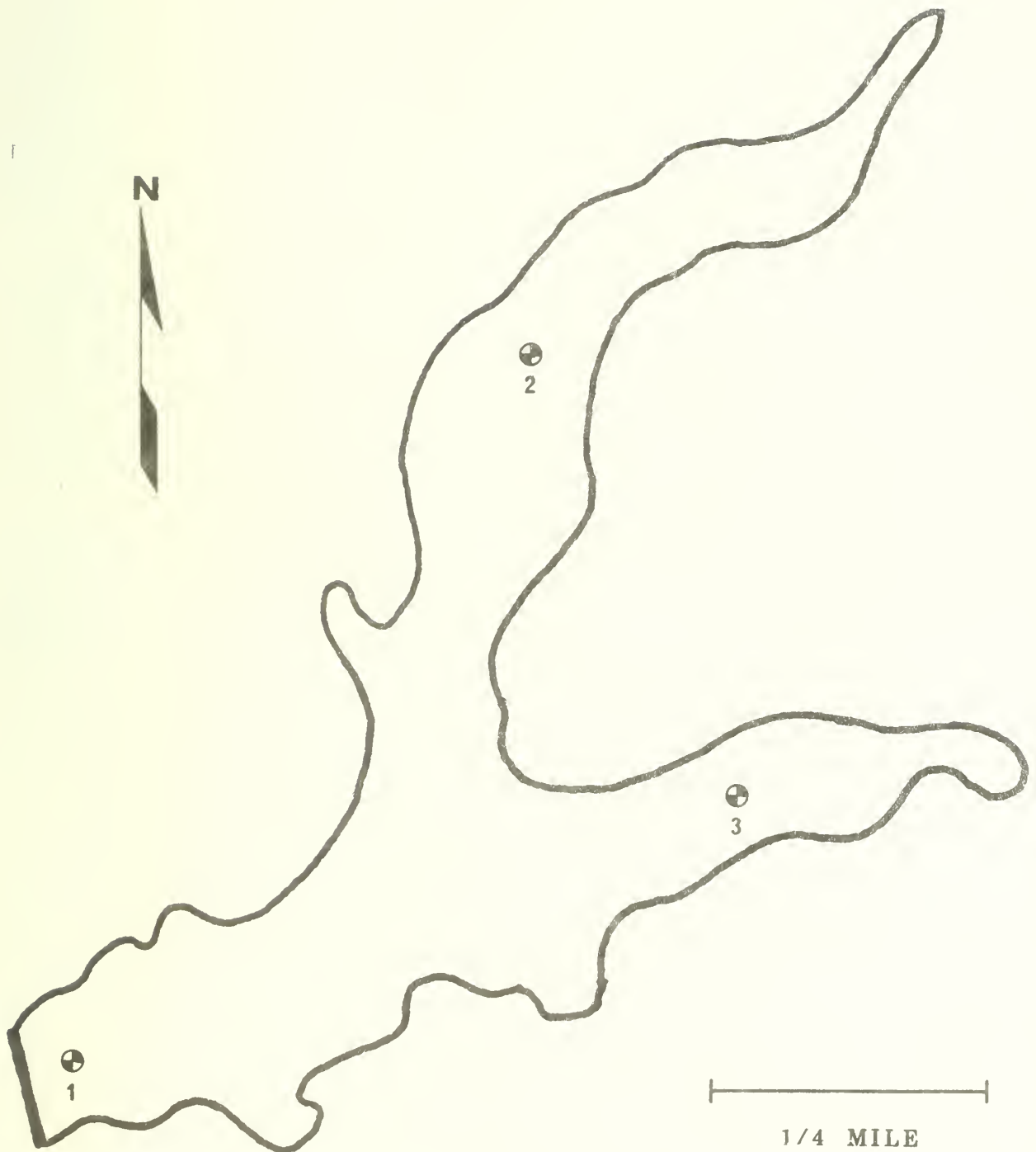


TABLE 2

SECCHI DISC TRANSPARENCY (INCHES) BORAH/RICHLAND COUNTY, ILLINOIS (VOLUNTEER DATA 1981)

DATE	SITE 1	SITE 2	SITE 3	MEAN	STD DEV
05/12	156.0	114.0	138.0	136.0	21.1
06/3	66.0	42.0	50.0	50.0	13.0
06/17	102.0	96.0	96.0	98.0	3.5
07/3	68.0	54.0	60.0	58.0	3.5
07/19	114.0	102.0	102.0	106.0	6.0
08/17	60.0	60.0	72.0	64.0	6.0
09/18	48.0	48.0	48.0	46.0	0.0
10/7	108.0	102.0	72.0	94.0	10.3

SUMMARY STATISTICS

SITES	LAKE
MEAN	80.3
STD DEV	36.0
MIN	46.0
MAX	156.0
AV DEPTH	26.0

-1 = missing value

See glossary for explanation of Summary Statistics.

TABLE 3

DEPTH OF SITE (FEET) BORAH/RICHLAND COUNTY, ILLINOIS (VOLUNTEER DATA 1981)

DATE	SITE 1	SITE 2	SITE 3	MEAN	STD DEV
05/12	25.0	0.5	11.5	15.3	8.4
06/3	25.5	10.0	11.5	15.7	8.5
06/17	26.5	10.0	13.5	16.7	8.7
07/3	25.5	9.0	11.5	15.3	8.0
07/19	26.0	10.5	12.0	16.2	0.5
08/17	26.5	11.0	13.0	16.8	8.4
09/18	27.0	10.5	13.0	16.8	0.0
10/7	26.0	10.0	8.0	14.7	9.9

SUMMARY STATISTICS

SITES	LAKE
MEAN	26.0
STD DEV	26.7
MIN	0.5
MAX	27.0
AV DEPTH	26.0

-1 = missing value

See glossary for explanation of Summary Statistics.

FIGURE 2

SECCHI DISC TRANSPARENCY (INCHES) BORAH/RICHLAND COUNTY, ILLINOIS (VOLUNTEER DATA 1981)

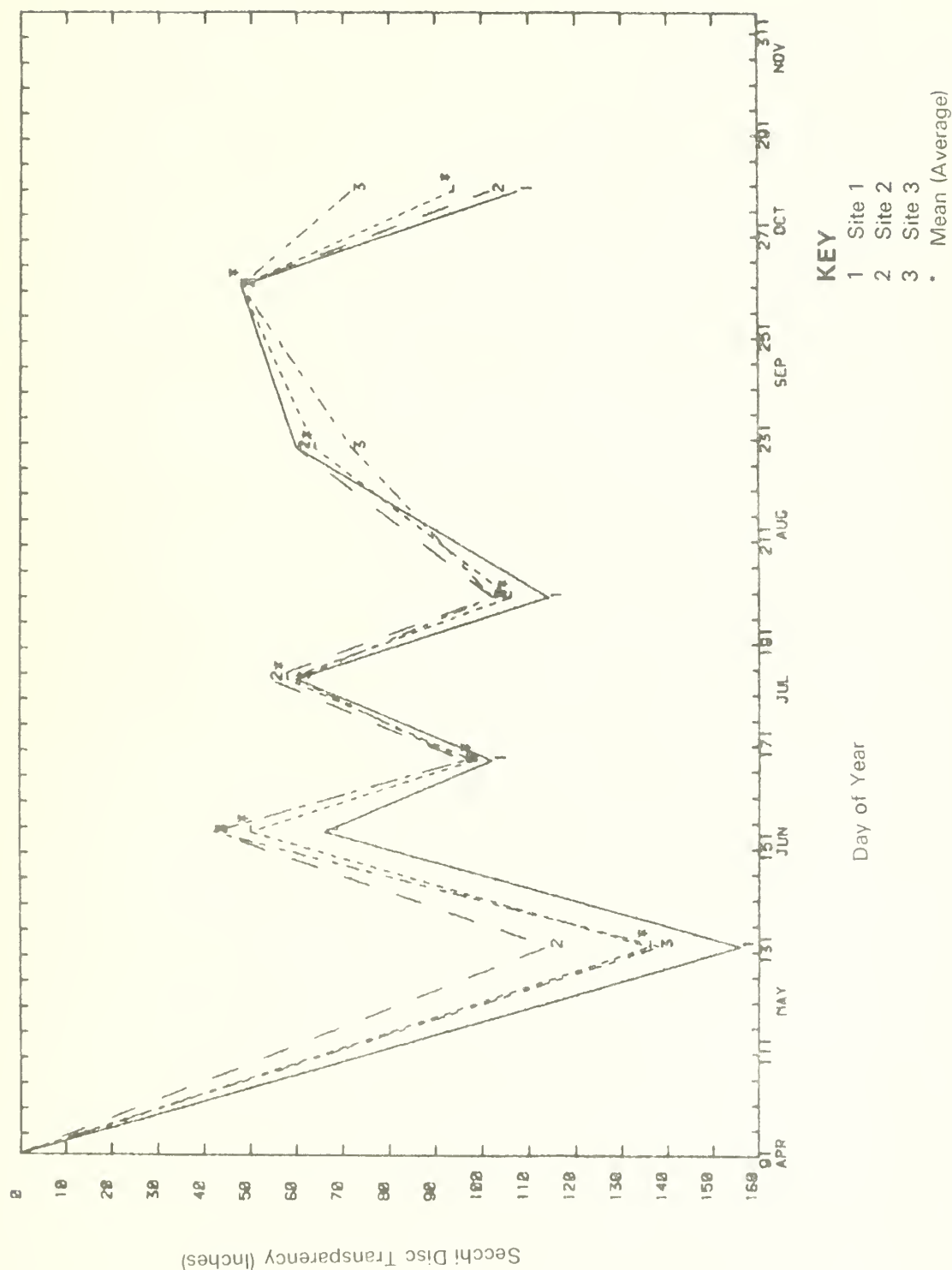


TABLE 4. FIELD OBSERVATIONS, BORAH, RICHLAND COUNTY, ILLINOIS.

DATE	OBSERVATION	SITE 1	SITE 2	SITE 3	WEATHER AT LAKE	PRESENT	PRECEDING 24 HOURS	OTHER COMMENTS
5/12/81	WATER COLOR: SEDIMENT: ALGAE: WEEDS AT SAMPLE SITE: WEEDS NEAR SHORE: OTHER SUBSTANCES: ODOR:	brnsh-grn minimal minimal moderate none no odor	brnsh-grn minimal minimal moderate none no odor	brnsh-grn minimal minimal moderate none no odor	CLOUD COVER: PRECIPITATION: WAVES: AIR TEMPERATURE: WIND DIRECTION:	hazy no rain ripple cool SE	many clouds heavy rain white caps cool	WATER LEVEL OF LAKE: normal RECREATIONAL USAGE: fishing LAKE MANAGEMENT: none ADDITIONAL COMMENTS: Some dead fish were along the shore. Sunfish & bluegills have a fungus infection
6/3/81	WATER COLOR: SEDIMENT: ALGAE: WEEDS AT SAMPLE SITE: WEEDS NEAR SHORE: OTHER SUBSTANCES: ODOR:	grnsh-brn slight minimal minimal none no odor	grnsh-brn slight minimal minimal slight none no odor	grnsh-brn slight minimal minimal slight none no odor	CLOUD COVER: PRECIPITATION: WAVES: AIR TEMPERATURE: WIND DIRECTION:	clear no rain calm hot SE	many clouds lt. rain small hot SE	WATER LEVEL OF LAKE: full RECREATIONAL USAGE: fishing, row boating, canoeing, swimming, picnicking LAKE MANAGEMENT: ADDITIONAL COMMENTS:
6/17/81	WATER COLOR: SEDIMENT: ALGAE: WEEDS AT SAMPLE SITE: WEEDS NEAR SHORE: OTHER SUBSTANCES: ODOR:	brnsh-grn moderate slight slight dead fish no odor	brnsh-grn moderate moderate slight slight no odor	brnsh-grn moderate moderate slight slight no odor	CLOUD COVER: PRECIPITATION: WAVES: AIR TEMPERATURE: WIND DIRECTION:	clear no rain calm hot SE	clear v. lt. rain ripple warm	WATER LEVEL OF LAKE: normal RECREATIONAL USAGE: fishing, swimming, picnicking LAKE MANAGEMENT: ADDITIONAL COMMENTS:
7/3/81	WATER COLOR: SEDIMENT: ALGAE: WEEDS AT SAMPLE SITE: WEEDS NEAR SHORE: OTHER SUBSTANCES: ODOR:	grnsh-brn moderate slight moderate none no odor	grnsh-brn moderate slight minimal moderate none no odor	grnsh-brn moderate slight minimal moderate none no odor	CLOUD COVER: PRECIPITATION: WAVES: AIR TEMPERATURE: WIND DIRECTION:	few clouds mod. rain ripple warm SE	overcast lt. rain small warm	WATER LEVEL OF LAKE: normal RECREATIONAL USAGE: fishing, swimming, power boating, camping LAKE MANAGEMENT: ADDITIONAL COMMENTS: This lake started out with 13' readings, & has now dropped to 4½ & 5'

*algae in suspension

TABLE 4. FIELD OBSERVATIONS, BORAH LAKE, RICHLAND, ILLINOIS.

DATE	OBSERVATION	SITE 1	SITE 2	SITE 3	WEATHER AT LAKE	PRESENT	PRECEDING 24 HOURS	OTHER COMMENTS
7/19/81	WATER COLOR: SEDIMENT: ALGAE: WEEDS AT SAMPLE SITE: WEEDS NEAR SHORE: OTHER SUBSTANCES: ODOR:	grnsh-brn moderate slight moderate none no odor	grnsh-brn moderate moderate slight moderate none no odor	grnsh-brn moderate moderate slight moderate none no odor	CLOUD COVER: PRECIPITATION: WAVES: AIR TEMPERATURE: WIND DIRECTION:	clear no rain small warm NE	clear mod. rain small warm NE	WATER LEVEL OF LAKE: normal RECREATIONAL USAGE: fishing, swimming, power boating, waterskiing, row boating/ canoeing, camping LAKE MANAGEMENT: ADDITIONAL COMMENTS:
8/17/81	WATER COLOR: SEDIMENT: ALGAE: WEEDS AT SAMPLE SITE: WEEDS NEAR SHORE: OTHER SUBSTANCES: ODOR:		mod. green slight minimal moderate none no odor	mod. green slight minimal large none no odor	WEATHER AT LAKE CLOUD COVER: PRECIPITATION: WAVES: AIR TEMPERATURE: WIND DIRECTION:	clear no rain ripple warm SE	many clouds mod. rain moderate warm NW	WATER LEVEL OF LAKE: swimming, water- RECREATIONAL USAGE: skiing, picnicking LAKE MANAGEMENT: none ADDITIONAL COMMENTS:
9/18/81	WATER COLOR: SEDIMENT: ALGAE: WEEDS AT SAMPLE SITE: WEEDS NEAR SHORE: OTHER SUBSTANCES: ODOR:	very green slight moderate slight large none no odor	very green slight moderate slight large algal mats no odor	very green slight moderate large algal mats no odor	WEATHER AT LAKE CLOUD COVER: PRECIPITATION: WAVES: AIR TEMPERATURE: WIND DIRECTION:	few clouds no rain ripple warm SE	hazy v. lt. rain small warm NW	WATER LEVEL OF LAKE: normal RECREATIONAL USAGE: fishing, power boating LAKE MANAGEMENT: ADDITIONAL COMMENTS: We have just had between 7 - 8" of rain in the past week.
10/7/81	WATER COLOR: SEDIMENT: ALGAE: WEEDS AT SAMPLE SITE: WEEDS NEAR SHORE: OTHER SUBSTANCES: ODOR:	grnsh-brn slight moderate slight moderate none no odor	grnsh-brn slight moderate slight moderate none no odor	grnsh-brn slight moderate slight moderate none no odor	WEATHER AT LAKE CLOUD COVER: PRECIPITATION: WAVES: AIR TEMPERATURE: WIND DIRECTION:	clear no rain ripple cool SE	hazy v. lt. rain small cool NW	WATER LEVEL OF LAKE: normal RECREATIONAL USAGE: fishing LAKE MANAGEMENT: ADDITIONAL COMMENTS:

There were seasonal differences in the transparency of Borah Lake. The transparency fluctuated quite a bit from one sampling date to the next through the season. Lowest transparencies were recorded on September 18. The September sampling followed 7-8 inches of rain in the Borah Lake area.

Field observations of water color and amount of algae and suspended sediment present indicate that the transparency of Borah Lake is influenced by both algae and suspended sediment in early and mid-summer, and primarily by algae in late summer and early fall.

Relationship to Lake Use

Secchi disc transparency may indicate the potential of the lake for exhibiting water quality and use impairment problems. It may also help a fisherman locate the most likely fish habitat.

Generally, from the surface to between two and five times the Secchi disc depth can be considered the euphotic (lighted) zone of the lake; in this region there is enough light to allow plants to survive and produce oxygen by photosynthesis. This is also the zone of greatest fish activity. Waters below the euphotic zone can be expected to have little or no dissolved oxygen during the summer if the lake is thermally stratified (has layers of water of different temperatures). During this stratification period, fish will probably be limited to the euphotic or aerobic (oxygenated) zone of the lake.

The lower limit of the euphotic zone of Borah Lake (estimated at twice the Secchi depth) ranged from 8-26 feet at Site 1, 7-19 feet at Site 2, and 7-23 feet at Site 3. Since Site 1 on Borah Lake is deep enough to thermally stratify and the euphotic zone was generally less than the total depth, low dissolved oxygen values would be expected in the bottom waters of this site during summer stratification.

In the absence of dissolved oxygen, undesirable substances such as hydrogen sulfide, ammonia, methane, phosphorus, iron, and manganese are released from the sediments and accumulate in the bottom waters. These substances can contribute to serious taste and odor problems in drinking water if water supply is taken from near the lake bottom during summer stratification. When substances which have accumulated in the bottom waters are distributed throughout the lake during mixing periods, they can also trigger nuisance algal blooms, aquatic weed growth, taste and odor, and other water quality problems.

SUMMARY AND RECOMMENDATIONS

Summary

Borah Lake, a recreational and reserve public water supply impoundment in south-central Illinois, was sampled on 8 dates between May 1 and October 31, 1981 under the Illinois EPA's Volunteer Lake Monitoring Program. Volunteer Arthur Omland recorded Secchi disc transparency, total depth, and field observations at three sites and reported results to the Illinois EPA.

The average Secchi disc transparency of Borah Lake (81.8 inches) ranked 8th of the 87 lakes monitored by volunteers in 1981 (rank 1 is clearest; 87 is least transparent). This average transparency was greater than the four feet minimum recommended for swimming by the Department of Public Health and was above average for Illinois lakes.

The transparency of Borah Lake fluctuated quite a bit from one sampling date to the next, but generally was more than four feet. Lowest transparencies were recorded on September 18, following 7-8 inches of rain in the Borah Lake area. Site 1 was generally clearer than Sites 2 and 3. Field observations indicate that the transparency of Borah Lake is influenced by both algae and suspended sediment in early and mid-summer, and primarily by algae in later summer and early fall.

Site 1 on Borah Lake is deep enough to thermally stratify during the summer. Since the lower limit of its euphotic zone (estimated at twice the Secchi depth) is generally less than the total depth, low bottom water dissolved oxygen values, associated water quality problems, and limitation of fish habitat may be expected during summer stratification.

Borah Lake is undergoing the process of eutrophication as evidenced by transparency readings and field observations of algae, weed, and sediment problems. Protection from further degradation is critical. If nutrient and sediment input were controlled, lake quality would probably improve; failure to control inputs will probably result in continued rapid eutrophication. Lake managers should identify sources of nutrient and sediment input and take steps to control them before the lake becomes degraded.

Recommendations

Developing a management plan for a lake requires a comprehensive assessment of the lake and watershed and is beyond the scope of this project. However, some suggestions regarding lake management are presented below for consideration; their applicability to this lake would require further study. Alternative options not presented here may also apply.

Lake managers should work with the Soil and Water Conservation District and the Soil Conservation Service to develop a procedure to identify and quantify non-point pollution source areas. This procedure should allow for the targeting of resources and programs to correct the identified problems.

Installation of agricultural Resource Management Systems in source areas of the watershed may reduce nutrient and sediment transport to the lake. The septic tanks of homes surrounding the lake are likely sources of nutrient input; their contribution should be investigated and minimized. Fertilization of lawns may also contribute to the problem. Shoreline erosion due to boating activities is cited as a possible pollution source; riprapping of the shoreline and regulation of boating speeds could help control this.

In-lake management may also warrant consideration. Drawing oxygenated water from the upper strata for water supply use may help alleviate taste and odor problems. Aeration-destratification to prevent dissolved oxygen depletion may promote a shift in algal populations to species other than the problem causing blue-greens, alleviate taste and odor problems, and improve fishing. Harvesting of aquatic weeds might also be considered.

Continued monitoring is recommended for Borah Lake. Consistent data gathered over a period of years is necessary to more fully document water quality trends, identify problems, and evaluate lake/watershed management strategies.

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GLOSSARY*

acre-foot - the volume of water required to cover one acre to a depth of one foot and equal to 0.3258 million gallons; a unit of storage capacity obtained by multiplying surface area (in acres) by average depth (in feet).

aeration-destratification - the addition of air to the water through mechanical means to increase the dissolved oxygen content of the bottom waters of lakes by eliminating thermal stratification and homogenizing the entire water column.

aerobic - conditions characterized by the presence of oxygen.

algae - one-celled or colonial photosynthetic plants (usually microscopic), found suspended in water or attached to damp rocks or other substrates.

algal bloom - a large number of planktonic algae, which often turns the water green and may produce objectionable scums and odors; a condition in which algae cloud the water noticeably.

ambient - existing condition or level at the time and place.

ammonia - a colorless, gaseous, alkaline compound which is a decompositional end product of nitrogen-containing organic matter; its importance in fresh water is associated with its toxicity to aquatic organisms and its use as a nutrient for aquatic plant growth.

anaerobic - conditions characterized by the absence of oxygen.

anoxic - without oxygen.

aquatic - growing or living in water; pertaining to water.

aquatic weeds - larger plants easily visible to the naked eye which are submergent, floating or emergent in the water.

artificial - man-made; constructed.

average depth - mean depth of a lake, calculated by dividing the volume (storage capacity) by the surface area.

backwater (or river backwater) - water impoundment located along the side of a stream or river which may flood periodically or have a direct connection to the stream at all times.

blue-green algae - a group of one celled or colonial plants of the phylum Cyanophyta, which live in water or damp places and reflect a blue to dark green tint; most often responsible for nuisance algal blooms with scum and odors.

borrow pit - a water impoundment formed by removal of earth for fill construction in the making of roads, dikes, bridges and levees

bottomland lake - natural water impoundment located in a river floodplain

circulation period - mixing period for a lake; period of time in which the entire lake volume is not thermally stratified and is totally mixed by wind action.

condition - the overall quality of the lake for supporting general use

detritus - finely divided organic and inorganic settleable material suspended in the water

diatoms - a group of one-celled or colonial algae living in water or damp places which are characterized by the presence of yellow-green or brown pigments and cell walls which contain silica and are composed of two halves (valves), one overlapping the other like the top and bottom of a pill box

drainage area - watershed; the land surface surrounding the lake which contributes water via surface runoff to the lake

ecology - the study of the relationship of organisms to their environment

emergent - a rooted aquatic plant with parts normally extending above the water surface

epilimnion - upper, relatively warm, circulating zone of water in a thermally stratified lake

euphotic zone - region of a lake where light penetration is sufficient to maintain photosynthesis; its lower limit is generally two to five times the Secchi disc transparency.

eutrophic - waters which are rich in plant nutrients and capable of supporting high biological productivity; USEPA defines a eutrophic lake as one that exhibits any of the following characteristics: biomass accumulations of primary producers (algal blooms and excessive aquatic weeds); rapid organic or inorganic sedimentation and shallowing; or seasonal dissolved oxygen deficiencies in the bottom waters and subsequent shift in species composition of aquatic fauna to forms that can tolerate lower concentrations of oxygen.

eutrophication - lake aging through nutrient enrichment and sedimentation.

fertile - waters rich in plant nutrients.

glacial lake - body of standing water formed by glacial action.

green algae - a group of one-celled or colonial plants of the phylum Chlorophyta, which live in water or damp areas and reflect a greenish tint.

hydrogen sulfide - a gaseous compound produced under anaerobic conditions which has a rotten egg smell.

hypolimnion - lower, relatively cold, noncirculating zone in a thermally stratified lake.

impairment - that which damages or negatively impacts the present or potential use of a body of water.

impoundment - a body of standing water constructed by artificial means or formed by nature.

in-lake treatment or control techniques - methods to limit the availability of pollutants already in the lake or to accelerate their outflow; and various physical, chemical and biological approaches for managing the consequences of degradation and enhancing the usability of the lake without controlling the source of the degradation.

iron - an essential micronutrient, which is considered objectionable in water supplies because it can cause taste and odor problems and stain laundry.

lake - a body of standing water 6.0 acres or more in surface area (as defined by the Illinois Department of Conservation).

lake code - an eight-digit combination of letters and numbers used to identify a lake in the computer.

limnologist - aquatic ecologist; one who studies the physical, chemical, and biological aspects of lakes.

limnology - the study of the ecology of inland lakes.

littoral - shoreward region of a body of water.

macrophyte - large plant of macroscopic size (easily visible to the naked eye).

management - non-structural measures designed to enhance the quality and usability of a lake.

manganese - an essential micronutrient, which is considered objectionable at high concentrations because it can cause taste and odor problems.

maximum (max) - highest (largest) value observed in a data set.

maximum depth - depth of deepest point in a lake.

mean - a statistical term for average, calculated by totalling the values and dividing by the number of observations.

mean depth - the volume of a lake divided by its surface area; average depth.

mesotrophic - waters intermediate in character between oligotrophic and eutrophic; moderately well supplied with plant nutrients and capable of supporting moderate biological productivity.

minimum (min) - smallest (lowest) value observed in a data set.

mixing period - circulation period of a lake; period of time in which the lake is not thermally stratified and is totally mixed by wind action.

nitrogen - an element which is an essential plant nutrient and is one of the principal elemental constituents of proteins.

nonpoint pollution - pollution from diffuse sources (e.g., agriculture, forestry operations, mining, construction) for which a specific point of discharge cannot be readily identified.

nutrient - any chemical element, ion or compound that is required by an organism for the continuation of growth, reproduction and other life processes; nitrogen and phosphorus are usually growth limiting factors for aquatic plants.

oligotrophic - waters with low concentrations of plant nutrients and hence capable of supporting little biological productivity.

organizational impoundment - body of standing water owned, leased or maintained by an organization of six or more members (as defined by the Illinois Department of Conservation).

phosphorus - an element which is an essential plant nutrient and plays a vital role in the energy transfer during cell metabolism.

photosynthesis - the process by which green plants use the sun's energy to convert dioxide and water into chemical energy (carbohydrates, fats, and proteins).

phytoplankton - microscopic plants (algae) that drift passively in open water regions of lakes and rivers.

plankton - the community of microscopic plants and animals that drift passively in open water regions of lakes and rivers.

point source pollution - pollution emanating from a discharge point such as a pipe which can be specifically identified (e.g., sewage treatment plants, manufacturing plants).

pollution - any substance which makes another unclean or impure.

pond - small body of standing water less than 6.0 acres in surface area (as defined by the Illinois Department of Conservation).

potable - of quality for drinking.

private impoundment - body of standing water privately owned or leased with no fee charged for use (as defined by the Illinois Department of Conservation).

production - total amount of living matter produced in a lake per unit time.

productivity - rate at which organic material (and energy) is produced and transferred through organisms in an ecosystem; standing crop of organisms that can be supported.

protection - pollution abatement or control; measures to prevent pollution from entering a lake, including methods to stop the pollution at its source or to treat it before it reaches the lake.

public access - publicly owned contiguous land or easements providing any member of the public the same or equivalent opportunity to enjoy privileges and benefits of the lake as any other member of the public or as any resident around the lake.

public impoundment - body of standing water owned and maintained by a governmental agency (excluding the Illinois Department of Conservation) that have public access.

public water supply - used as a municipal water supply for domestic needs.

Resource Management Systems - best management practices for the control and abatement of nonpoint pollution; a combination of agricultural practices which reduce soil erosion and/or increase water retention.

restoration - structural measures designed to return a lake to its original condition (e.g., dredging to original depth).

reservoir - a watershed impoundment artificially constructed by damming of a stream.

resuspend - cause to be suspended in the water.

river basin - drainage area for a large river.

seasonal - over a period of time (seasonal).

Secchi disc - an eight-inch diameter weighted metal plate painted black and white in alternating quadrants which is lowered into the water on a calibrated line to measure the transparency or clarity of the water.

Secchi disc depth - the depth into the water to which a black and white circular disc can be seen when viewed from the surface; a measure of water transparency or its ability to allow vertical light penetration.

sediment - the solid materials (particulate matter) transported by, suspended in or deposited from, water; includes fragmentary material that originates from weathering of rock, chemical and biochemical precipitants and decomposed organic material such as humus.

sediment-related turbidity - muddiness; cloudiness or opaqueness of the water caused by suspended sediment.

sedimentation - deposition of organic and/or inorganic particulate matter.

sedimentation surveys - measurement of the amount of sediment deposited in a water body.

segments - a subwatershed within a large river basin.

spatial - differences over an area.

standard deviation (Std. Dev.) - a statistical term to describe the variability of the data around the mean (average); if the magnitude of the standard deviation is "small" relative to the mean, then most of the values are close to the mean in magnitude and the data has little variability (is relative uniform); if the standard deviation is large in magnitude relative to the mean, then the data is more variable.

state impoundment - a body of standing water owned or leased and maintained by the Illinois Department of Conservation.

storage capacity - volume of water an impoundment can hold; often expressed in acre-feet, million gallons, and cubic meters.

submergent - an aquatic plant that lives and grows entirely below the surface of the water.

succession - in ecology, the progressive change of plant and animal life in an area.

suspended sediment - the sediment that at any given time is maintained in suspension by current or as a colloid.

suspended solids - particulate material that at any given time is maintained in suspension by current or as a colloid; total suspended solids are all suspended particular material, volatile and non-volatile, organic and inorganic; volatile suspended solids is that suspended particulate material, generally organic in nature, which undergoes combustion at a temperature of 600°C.

suspension - a heterogenous mixture in which the particles of one substance are kept dispersed by agitation.

thermal stratification - the layering of the water in a lake due to different densities as a function of temperature; the layers are the epilimnion (upper), metalimnion or thermocline (middle), and the hypolimnion (lower).

thermocline - metalimnion; the middle layer of water in a thermally stratified lake in which temperature decreases rapidly with increasing depth.

transparency - ability to allow light penetration and be seen through; clarity.

trophic state - the degree of eutrophication of a lake; the rate of primary biological production it is capable of supporting.

turbid - cloudy, opaque, murky, dirty-looking; containing suspensoids (organic or inorganic) which interfere with light penetration.

turbidity - amount of scattering of light caused by material suspended in the water.

use impairment - that which damages or negatively impacts the present or potential use of a body of water.

water quality - the suitability of the water for supporting various uses.

water retention time - water residence time; period of time a mass of water remains in an impoundment.

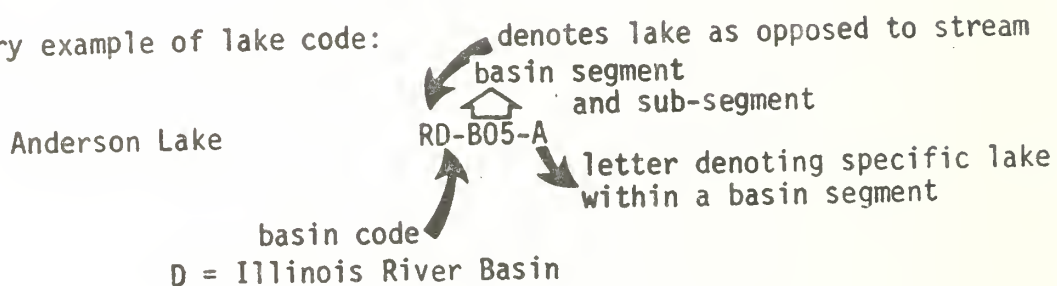
watershed - drainage area; the land surface surrounding the lake which contributes water, via surface runoff, to the lake; the total or contributing watershed area is the total draining to the lake, including the lake surface area; the immediate or net watershed is the portion of the total watershed (free of lakes or sloughs) from which direct, unimpeded surficial runoff drains to the lake.

zooplankton - animal portion of the community of suspended or floating organisms which drift passively with the water currents.

ABBREVIATIONS AND SYMBOLS

av - average
brn - brown
brnsh-grn - brownish-green
grn-brn - green-brown
grnsh-brn - greenish-brown
lt - light
max - maximum value
min - minimum value
mod - moderately
std. dev. - standard deviation
v - very

Explanatory example of lake code:



*Definitions of items in sense used in text

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1981 VOLUNTEER LAKE

MONITORING PROGRAM REPORT

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LAKE BLOOMINGTON / McLEAN Co.

1981 VOLUNTEER LAKE MONITORING PROGRAM REPORT
FOR
LAKE BLOOMINGTON, MCLEAN COUNTY, ILLINOIS

A Cooperative Citizen-
Illinois Environmental Protection Agency
Project

May, 1982
Illinois Environmental Protection Agency
2200 Churchill Road
Springfield, Illinois 62706

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INTRODUCTION

A cooperative volunteer lake monitoring effort was initiated by the Illinois EPA in 1981 as part of an overall self-help, service program being developed for lakes. In addition to expanding the Agency's lakes data base with information on present water quality and trends, the program was designed to involve citizens in learning about a lake so they could make more informed decisions regarding its use, protection, and enhancement.

Citizens selected a lake they were concerned about and were trained to measure water clarity or transparency by recording the depth to which a Secchi disc (an eight-inch diameter metal plate painted black and white in alternating quadrants) was visible. They also measured total depth and recorded field observations from a boat at three sites on their chosen lake. Readings were to be taken twice a month from May through October and reported to the Agency on special data forms. The Secchi disc, data forms, and postage paid envelopes were provided by the Agency. Volunteers were required to have a boat with an anchor to perform the monitoring.

Approximately 140 volunteers participated in monitoring 87 lakes in 1981. The sampling data were computerized to facilitate analyses and preparation of tables and graphs for reports. A statewide report entitled "Volunteer Lake Monitoring, 1981", summarized all the data for the volunteer lakes. Individual reports were also prepared for each of the 87 lakes monitored by volunteers in 1981.

BACKGROUND

Lake Bloomington is a 635 acre impoundment owned by the City of Bloomington, McLean County, Illinois. The lake, which was constructed by damming Money Creek in 1930, has a maximum depth of 35.0 feet, an average depth of 14.0 feet and a storage capacity of 8,800 acre-feet (Table 1).

Lake Bloomington serves as a potable water supply for the City. Primary recreational uses associated with the lake are fishing, power boating, waterskiing, row boating or canoeing, sailboating and picnicking. Access is limited, but free.

The 45,440 acre watershed of Lake Bloomington is estimated to be 80% row crops. The lake shoreline is primarily residential. Deposition of sediment and water level fluctuation are considered moderate problems. Cropland runoff, fertilizer or pesticides from lawns/golf courses, septic tanks, feedlot runoff and pasture or grassland runoff are cited as potential pollution sources.

Assessment information on Lake Bloomington was provided by Murray C. Marks, the Water Treatment Plant Operator, and the Illinois State Water Survey. Monitoring was performed by Richard L. Carter. Secchi disc transparency, total depth, and field observations were recorded by at three sites (located in Fig. 1) on the following dates: May 1 and 21 and June 12 and 30, 1981.

TABLE 1. LAKE ASSESSMENT SUMMARY, LAKE BLOOMINGTON, MCLEAN COUNTY, ILLINOIS (RD-A03-0).

I. GENERAL INFORMATION

River Basin: Illinois
Segment: A03

Ownership: City of Bloomington

Surface Area (Acres): 635*
Watershed Area (Acres): 45,440*
Maximum Depth (Feet): 35*
Average Depth (Feet): 14*
Storage Capacity (Acre/Feet): 8,800*
Inflowing Stream(s): Money Cr.; Hickory Cr.*
Outflowing Stream(s): Money Cr.*
Water Retention Time: 0.285 year
Lake Type: Dammed stream
Year Constructed: 1929 - 30 (dam raised 5' in 1958)

II. USAGE

Public Access: yes

Lake Usage:

Potable Water Supply: heavy
Industrial Water Supply: none
Agricultural Water Supply: none
Cooling Water: none
Recreation:
Fishing: moderate
Swimming: light
Power Boating: moderate
Row Boating or Canoeing: moderate
Sailboating: moderate
Camping: none
Picnicking: moderate
Waterfowl Hunting: none
Waterfowl Observation: light
Other: water skiing - moderate

Recreational Facilities:
picnic areas, boat launch, concessions.

Shoreline Usage (Percent):

Urban (Including Streets):
Residential (Including Lawns): 45%
Golf Courses:
Pasture or Grassland: 35%
Woodland: 20%
Row Crops:
Wetland:
Other:

Watershed Usage (Percent):

Urban: 2%
Residential:
Golf Courses:
Pasture or Grassland: 8%
Woodland: 10%
Row Crops: 80%
Wetland:
Other:

III. WATER QUALITY AND PROBLEMS

General Water Quality: good
Fishing: good

Conditions and Extent:

Suspended Sediment: slight
Deposition of Sediment: moderate
Algal Blooms: slight
Aquatic Weeds: slight
Taste and/or Odor: slight
Water Level Fluctuation: moderate
Fishkills: minimal
Other:

IV. CAUSES OF WATER QUALITY PROBLEMS

Potential Pollution Sources:

Sewage Treatment Plant Effluent:
Industrial Discharge:
Urban Storm Drainage:
Septic Tanks: yes
Pasture or Grassland Runoff: yes
Cropland Runoff: yes
Feedlot Runoff: yes
Construction Site Runoff:
Fertilizer or Pesticides from
Lawns/Golf Courses: yes
Orchards:
Forestry Operations Runoff:
Mining:
Waterfowl:
Sediment in Lake:
Other:

V. LAKE MANAGEMENT

Comments: copper sulfate used usually one
time/year.

Information Supplied By M.C. Marks (1981), *Illinois State Water Survey, 1970.

FIGURE 1
LAKE BLOOMINGTON
MCLEAN COUNTY



RESULTS AND DISCUSSION

In this section, monitoring results will be presented for the lake and compared to those for other lakes in the volunteer program. Then spatial (within lake) and seasonal differences in transparency will be examined and related to field observations. Results will also be discussed in terms of lake uses. For an explanation of unfamiliar terms or concepts presented here, refer to the report "Volunteer Lake Monitoring, 1981", Section IV "Understanding Illinois' Lakes."

The Secchi monitoring data for Lake Bloomington are summarized in Table 2 and plotted in Fig. 2. Total depth data are provided in Table 3, while field observations are summarized in Table 4.

Transparency of Lake Bloomington

The average Secchi disc transparency of Lake Bloomington was 16.3 inches, which ranked number 69 when the average transparencies of the volunteer lakes were ranked from clearest (number 1 at 137.8 inches) to least transparent (number 87 at 7.3 inches). This average transparency was less than the four feet minimum recommended for swimming by the Illinois Department of Public Health (1976) and was in the range generally associated with use impairment problems for Illinois lakes. Above average rainfall during the sampling season may have resulted in lower than normal transparency.

Spatial and Seasonal Differences in Transparency

The Secchi transparency of Lake Bloomington ranged from a maximum of 30 inches at Sites 1 and 2 on June 12 to a minimum of 6 inches at all three sites on June 30.

A spatial trend of increasing transparency from the lake headwaters to the dam, as is typical of most Illinois reservoirs, was found to a lesser degree in Lake Bloomington. Secchi readings at Sites 1 and 2 were relatively uniform, while they were lower at Site 3. Average transparencies of Sites 3, 2, and 1 (headwaters to dam) were 13.5 inches, 17.0 inches and 18.5 inches, respectively.

The lake was turbid throughout the May-June sampling. Field observations indicated that the lack of transparency was due to both sediment and algae. A very brown water color was noted on the date with the lowest transparencies, while a brownish-green water color was noted on the other three sampling dates. Since Lake Bloomington was only sampled in May and June, seasonal differences in the transparency could not be determined.

TABLE 2

SECCHI DISC TRANSPARENCY (INCHES) BLOOMINGTON/MCLEAN COUNTY, ILLINOIS (VOLUNTEER DATA 1981)

DATE	SITE 1	SITE 2	SITE 3	MEAN	STD DEV
05/ 1	18.0	14.0	12.0	14.7	3.1
05/ 21	20.0	18.0	12.0	16.7	4.2
06/ 12	30.0	30.0	24.0	28.0	3.5
06/ 30	6.0	6.0	6.0	6.0	0.0

SUMMARY STATISTICS

SITES		LAKE	
MEAN	18.5	17.0	13.5
STD DEV	0.0	10.0	7.5
MIN	6.0	6.0	6.0
MAX	30.0	30.0	24.0
AV DEPTH	33.1	26.0	14.3

-1 = missing value

See glossary for explanation of Summary Statistics

TABLE 3

DEPTH OF SITE (FEET) BLOOMINGTON/MCLEAN COUNTY, ILLINOIS (VOLUNTEER DATA 1981)

DATE	SITE 1	SITE 2	SITE 3	MEAN	STD DEV
05/ 1	31.0	26.0	13.5	23.5	9.0
05/ 21	33.0	27.5	14.5	25.0	9.5
05/ 12	34.0	24.0	14.5	24.2	6.8
06/ 30	34.5	26.5	14.5	25.2	10.1

SUMMARY STATISTICS

SITES		LAKE	
MEAN	33.1	26.0	14.3
STD DEV	1.5	1.5	8.2
MIN	31.0	24.0	13.5
MAX	34.5	27.5	14.5
AV DEPTH	33.1	26.0	14.3

-1 = missing value

See glossary for explanation of Summary Statistics

FIGURE 2

SECCHI DISC TRANSPARENCY (INCHES) BLOOMINGTON/MCLEAN COUNTY, ILLINOIS (VOLUNTEER DATA 1981)

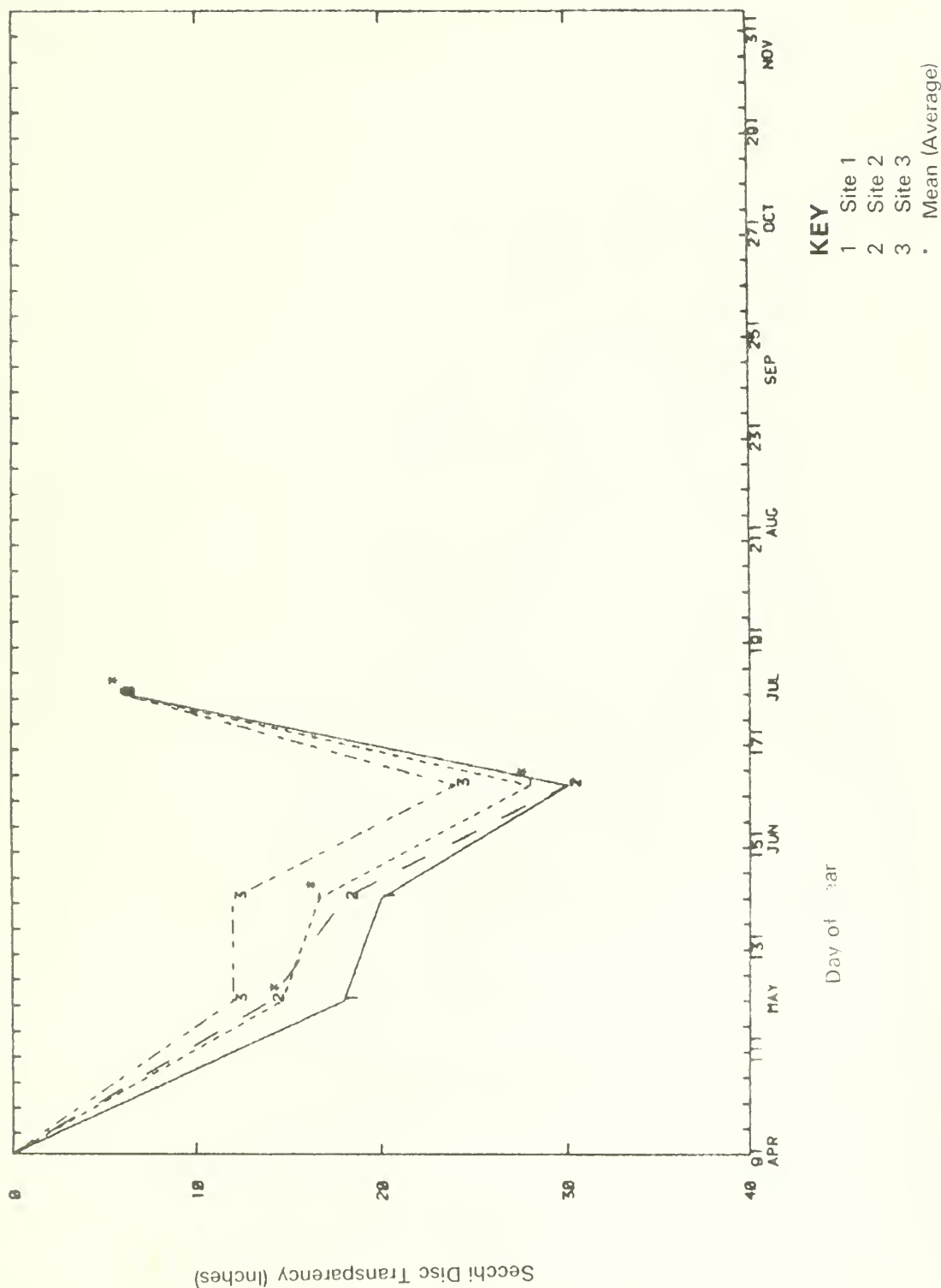


TABLE 4. FIELD OBSERVATIONS, LAKE BLOOMINGTON, MC LEAN COUNTY, ILLINOIS.

DATE	OBSERVATION	SITE 1	SITE 2	SITE 3	WEATHER AT LAKE	PRESENT	PRECEDING 24 HOURS	OTHER COMMENTS
5/1/81	WATER COLOR: SEDIMENT: ALGAE: WEEDS AT SAMPLE SITE: WEEDS NEAR SHORE: OTHER SUBSTANCES: ODOR:	brnsh-grn moderate minimal minimal none no odor	brnsh-grn moderate minimal minimal minimal none no odor	brnsh-grn moderate minimal minimal minimal none no odor	CLOUD COVER: PRECIPITATION: WAVES: AIR TEMPERATURE: WIND DIRECTION:	many clouds no rain moderate cool W	overcast lt. rain moderate cool W	WATER LEVEL OF LAKE: RECREATIONAL USAGE: LAKE MANAGEMENT: ADDITIONAL COMMENTS:
					OBSERVATIONS MADE BY:	Richard L. Castes		
DATE	OBSERVATION	SITE 1	SITE 2	SITE 3	WEATHER AT LAKE	PRESENT	PRECEDING 24 HOURS	OTHER COMMENTS
5/21/81	WATER COLOR: SEDIMENT: ALGAE: WEEDS AT SAMPLE SITE: WEEDS NEAR SHORE: OTHER SUBSTANCES: ODOR:	grnsh-brn minimal minimal minimal minimal none no odor	grnsh-brn minimal minimal minimal minimal none no odor	brnsh-grn slight minimal minimal minimal "clippings" no odor	CLOUD COVER: PRECIPITATION: WAVES: AIR TEMPERATURE: WIND DIRECTION:	clear no rain ripple warm W	clear no rain calm warm none	WATER LEVEL OF LAKE: RECREATIONAL USAGE: boating LAKE MANAGEMENT: ADDITIONAL COMMENTS:
					OBSERVATIONS MADE BY:	Richard L. Castes		
DATE	OBSERVATION	SITE 1	SITE 2	SITE 3	WEATHER AT LAKE	PRESENT	PRECEDING 24 HOURS	OTHER COMMENTS
6/12/81	WATER COLOR: SEDIMENT: ALGAE: WEEDS AT SAMPLE SITE: WEEDS NEAR SHORE: OTHER SUBSTANCES: ODOR:	very green minimal minimal minimal minimal none no odor	very green minimal minimal minimal slight waterfowl no odor	grnsh-brn minimal minimal minimal minimal dead fish no odor	CLOUD COVER: PRECIPITATION: WAVES: AIR TEMPERATURE: WIND DIRECTION:	clear no rain ripple hot S	overcast v. lt. rain small warm S	WATER LEVEL OF LAKE: RECREATIONAL USAGE: fishing, power boating, waterskiing, sailing LAKE MANAGEMENT: ADDITIONAL COMMENTS:
					OBSERVATIONS MADE BY:	Richard L. Castes		
DATE	OBSERVATION	SITE 1	SITE 2	SITE 3	WEATHER AT LAKE	PRESENT	PRECEDING 24 HOURS	OTHER COMMENTS
6/30/81	WATER COLOR: SEDIMENT: ALGAE: WEEDS AT SAMPLE SITE: WEEDS NEAR SHORE: OTHER SUBSTANCES: ODOR:	very brown large minimal slight none no odor	very brown large minimal minimal slight none no odor	very brown large minimal minimal minimal none no odor	CLOUD COVER: PRECIPITATION: WAVES: AIR TEMPERATURE: WIND DIRECTION:	few clouds no rain ripple hot E	hazy v. lt. rain small hot E	WATER LEVEL OF LAKE: RECREATIONAL USAGE: normal fishing LAKE MANAGEMENT: ADDITIONAL COMMENTS:
					OBSERVATIONS MADE BY:	Richard L. Castes		

Relationship to Lake Use

Secchi disc transparency may indicate the potential of the lake for exhibiting water quality and use impairment problems. It may also help a fisherman locate the most likely fish habitat.

Generally, from the surface to between two and five times the Secchi disc depth can be considered the euphotic (lighted) zone of the lake; in this region there is enough light to allow plants to survive and produce oxygen by photosynthesis. This is also the zone of greatest fish activity. Waters below the euphotic zone can be expected to have little or no dissolved oxygen during the summer if the lake is thermally stratified (has layers of water of different temperatures). During this stratification period, fish will probably be limited to the euphotic or aerobic (oxygenated) zone of the lake.

The lower limit of the euphotic zone of Lake Bloomington (estimated at twice the Secchi depth) ranged from 1.0 - 5.0 feet at Site 1, 1.0 - 5.0 feet at Site 2, and 1.0 - 4.0 feet at Site 3. Since Lake Bloomington is deep enough to thermally stratify and had a euphotic zone that was generally less than the total depth, low dissolved oxygen values would be expected in the bottom waters.

In the absence of dissolved oxygen, substances such as hydrogen sulfide, ammonia, methane, phosphorus, iron, and manganese may accumulate in the bottom waters. These substances can contribute to serious taste and odor problems in drinking water if water supply is taken from near the lake bottom during summer stratification. When these substances are distributed throughout the lake during mixing periods, they can trigger nuisance algal blooms, aquatic weed growth, and other water quality problems.

SUMMARY AND RECOMMENDATIONS

Summary

Lake Bloomington, a large public water supply impoundment in central Illinois, was sampled on four dates between April 15 and October 31, 1981 under the Illinois EPA's Volunteer Lake Monitoring Program. Volunteer Richard Castes recorded Secchi disc transparency, total depth, and field observations at three sites and reported results to the Illinois EPA.

The average Secchi disc transparency of Lake Bloomington (16.3 inches) ranked 69th of the 87 lakes monitored by volunteers in 1981 (rank 1 is clearest; 87 is least transparent). This average transparency was less than the four feet minimum recommended for swimming by the Department of Public Health and was in the range generally associated with use impairment problems for Illinois lakes. Field observations indicated that the transparency was influenced primarily by both sediment and algae.

Lake Bloomington is deep enough to thermally stratify during the summer. Since the lower limit of its euphotic zone (estimated at twice the Secchi depth) is generally less than the total depth, low bottom water dissolved oxygen values, associated water quality problems, and limitation of fish habitat may be expected during summer stratification.

Lake Bloomington undergoing the process of eutrophication, as evidenced by transparency readings and field observations of algae and sediment problems. Protection from further degradation is critical. If nutrient and sediment input were controlled, lake quality would probably improve; failure to control inputs will probably result in continued rapid eutrophication. Lake managers should identify sources of nutrient and sediment input and take steps to control them before the lake becomes further degraded.

Recommendations

Developing a management plan for a lake requires a comprehensive assessment of the lake and watershed and is beyond the scope of this project. However, some suggestions regarding lake management are presented below for consideration; their applicability to this lake would require further study. Alternative options not presented here may also apply.

Lake managers should work with the Soil and Water Conservation District and the Soil Conservation Service to develop a procedure to identify and quantify non-point pollution source areas. This procedure should allow for the targeting of resources and programs to correct the identified problems.

Installation of Resource Management Systems in source areas of the watershed may reduce nutrient and sediment transport to the lake. Stabilization of the lake shoreline by riprap or some other means may also reduce sediment input. Nutrient contributions from septic tanks and fertilization of lawns should also be investigated and minimized.

In-lake management may also warrant consideration. Drawing oxygenated water from the upper strata for water supply use may help alleviate taste and odor problems. Aeration-destratification to prevent dissolved oxygen depletion may promote a shift in algal populations to species other than the problem causing blue-greens, reduce the need for copper sulfate, help to alleviate taste and odor problems, and improve fishing.

Continued monitoring is recommended for Lake Bloomington. Consistent data gathered over a period of years is necessary to document and evaluate water quality trends, identify problems, and evaluate lake/watershed management strategies.

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DS:jab/sp2161c

GLOSSARY*

acre-foot - the volume of water required to cover one acre to a depth of one foot and equal to 0.3258 million gallons; a unit of storage capacity obtained by multiplying surface area (in acres) by average depth (in feet).

aeration-destratification - the addition of air to the water through mechanical means to increase the dissolved oxygen content of the bottom waters of lakes by eliminating thermal stratification and homogenizing the entire water column.

aerobic - conditions characterized by the presence of oxygen.

algae - one-celled or colonial photosynthetic plants (usually microscopic), found suspended in water or attached to damp rocks or other substrates.

algal bloom - a large number of planktonic algae, which often turns the water green and may produce objectionable scums and odors; a condition in which algae cloud the water noticeably.

ambient - existing condition or level at the time and place.

ammonia - a colorless, gaseous, alkaline compound which is a decompositional end product of nitrogen-containing organic matter; its importance in fresh water is associated with its toxicity to aquatic organisms and its use as a nutrient for aquatic plant growth.

anaerobic - conditions characterized by the absence of oxygen.

anoxic - without oxygen.

aquatic - growing or living in water; pertaining to water.

aquatic weeds - larger plants easily visible to the naked eye which are submergent, floating or emergent in the water.

artificial - man-made; constructed.

average depth - mean depth of a lake, calculated by dividing the volume (storage capacity) by the surface area.

backwater (or river backwater) - water impoundment located along the side of a stream or river which may flood periodically or have a direct connection to the stream at all times.

blue-green algae - a group of one celled or colonial plants of the phylum Cyanophyta, which live in water or damp places and reflect a blue to dark green tint; most often responsible for nuisance algal blooms with scum and odors.

borrow pit - a water impoundment formed by removal of earth for fill construction in the making of roads, dikes, bridges and levees

bottomland lake - natural water impoundment located in a river floodplain

circulation period - mixing period for a lake; period of time in which the entire lake volume is not thermally stratified and is totally mixed by wind action.

condition - the overall quality of the lake for supporting general use

detritus - finely divided organic and inorganic settleable material suspended in the water

diatoms - a group of one-celled or colonial algae living in water or damp places which are characterized by the presence of yellow-green or brown pigments and cell walls which contain silica and are composed of two halves (valves), one overlapping the other like the top and bottom of a pill box

drainage area - watershed; the land surface surrounding the lake which contributes water via surface runoff to the lake

ecology - the study of the relationship of organisms to their environment

emergent - a rooted aquatic plant with parts normally extending above the water surface

epilimnion - upper, relatively warm, circulating zone of water in a thermally stratified lake

euphotic zone - region of a lake where light penetration is sufficient to maintain photosynthesis; its lower limit is generally two to five times the Secchi disc transparency.

eutrophic - waters which are rich in plant nutrients and capable of supporting high biological productivity; USEPA defines a eutrophic lake as one that exhibits any of the following characteristics: biomass accumulations of primary producers (algal blooms and excessive aquatic weeds); rapid organic or inorganic sedimentation and shallowing; or seasonal dissolved oxygen deficiencies in the bottom waters and subsequent shift in species composition of aquatic fauna to forms that can tolerate lower concentrations of oxygen.

eutrophication - lake aging through nutrient enrichment and sedimentation.

fertile - waters rich in plant nutrients.

glacial lake - body of standing water formed by glacial action.

green algae - a group of one-celled or colonial plants of the phylum Chlorophyta, which live in water or damp areas and reflect a greenish tint.

hydrogen sulfide - a gaseous compound produced under anaerobic conditions which has a rotten egg smell.

hypolimnion - lower, relatively cold, noncirculating zone in a thermally stratified lake.

impairment - that which damages or negatively impacts the present or potential use of a body of water.

impoundment - a body of standing water constructed by artificial means or formed by nature.

in-lake treatment or control techniques - methods to limit the availability of pollutants already in the lake or to accelerate their outflow; and various physical, chemical and biological approaches for managing the consequences of degradation and enhancing the usability of the lake without controlling the source of the degradation.

iron - an essential micronutrient, which is considered objectionable in water supplies because it can cause taste and odor problems and stain laundry.

lake - a body of standing water 6.0 acres or more in surface area (as defined by the Illinois Department of Conservation).

lake code - an eight-digit combination of letters and numbers used to identify a lake in the computer.

limnologist - aquatic ecologist; one who studies the physical, chemical, and biological aspects of lakes.

limnology - the study of the ecology of inland lakes.

littoral - shoreward region of a body of water.

macrophyte - large plant of macroscopic size (easily visible to the naked eye).

management - non-structural measures designed to enhance the quality and usability of a lake.

manganese - an essential micronutrient, which is considered objectionable at high concentrations because it can cause taste and odor problems.

maximum (max) - highest (largest) value observed in a data set.

maximum depth - depth of deepest point in a lake.

mean - a statistical term for average, calculated by totalling the values and dividing by the number of observations.

mean depth - the volume of a lake divided by its surface area; average depth.

mesotrophic - waters intermediate in character between oligotrophic and eutrophic; moderately well supplied with plant nutrients and capable of supporting moderate biological productivity.

minimum (min) - smallest (lowest) value observed in a data set.

mixing period - circulation period of a lake; period of time in which the lake is not thermally stratified and is totally mixed by wind action.

nitrogen - an element which is an essential plant nutrient and is one of the principal elemental constituents of proteins.

nonpoint pollution - pollution from diffuse sources (e.g., agriculture, forestry operations, mining, construction) for which a specific point of discharge cannot be readily identified.

nutrient - any chemical element, ion or compound that is required by an organism for the continuation of growth, reproduction and other life processes; nitrogen and phosphorus are usually growth limiting factors for aquatic plants.

oligotrophic - waters with low concentrations of plant nutrients and hence capable of supporting little biological productivity.

organizational impoundment - body of standing water owned, leased or maintained by an organization of six or more members (as defined by the Illinois Department of Conservation).

phosphorus - an element which is an essential plant nutrient and plays a vital role in the energy transfer during cell metabolism.

photosynthesis - the process by which green plants use the sun's energy to convert dioxide and water into chemical energy (carbohydrates, fats, and proteins).

phytoplankton - microscopic plants (algae) that drift passively in open water regions of lakes and rivers.

plankton - the community of microscopic plants and animals that drift passively in open water regions of lakes and rivers.

point source pollution - pollution emanating from a discharge point such as a pipe which can be specifically identified (e.g., sewage treatment plants, manufacturing plants).

pollution - any substance which makes another unclean or impure.

pond - small body of standing water less than 6.0 acres in surface area (as defined by the Illinois Department of Conservation).

potable - of quality for drinking.

private impoundment - body of standing water privately owned or leased with no fee charged for use (as defined by the Illinois Department of Conservation).

production - total amount of living matter produced in a lake per unit time.

productivity - rate at which organic material (and energy) is produced and transferred through organisms in an ecosystem; standing crop of organisms that can be supported.

protection - pollution abatement or control; measures to prevent pollution from entering a lake, including methods to stop the pollution at its source or to treat it before it reaches the lake.

public access - publicly owned contiguous land or easements providing any member of the public the same or equivalent opportunity to enjoy privileges and benefits of the lake as any other member of the public or as any resident around the lake.

public impoundment - body of standing water owned and maintained by a governmental agency (excluding the Illinois Department of Conservation) that have public access.

public water supply - used as a municipal water supply for domestic needs.

Resource Management Systems - best management practices for the control and abatement of nonpoint pollution; a combination of agricultural practices which reduce soil erosion and/or increase water retention.

restoration - structural measures designed to return a lake to its original condition (e.g., dredging to original depth).

reservoir - a watershed impoundment artificially constructed by damming of a stream.

resuspend - cause to be suspended in the water.

river basin - drainage area for a large river.

seasonal - over a period of time (seasonal).

Secchi disc - an eight-inch diameter weighted metal plate painted black and white in alternating quadrants which is lowered into the water on a calibrated line to measure the transparency or clarity of the water.

Secchi disc depth - the depth into the water to which a black and white circular disc can be seen when viewed from the surface; a measure of water transparency or its ability to allow vertical light penetration.

sediment - the solid materials (particulate matter) transported by, suspended in or deposited from, water; includes fragmentary material that originates from weathering of rock, chemical and biochemical precipitants and decomposed organic material such as humus.

sediment-related turbidity - muddiness; cloudiness or opaqueness of the water caused by suspended sediment.

sedimentation - deposition of organic and/or inorganic particulate matter.

sedimentation surveys - measurement of the amount of sediment deposited in a water body.

segments - a subwatershed within a large river basin.

spatial - differences over an area.

standard deviation (Std. Dev.) - a statistical term to describe the variability of the data around the mean (average); if the magnitude of the standard deviation is "small" relative to the mean, then most of the values are close to the mean in magnitude and the data has little variability (is relative uniform); if the standard deviation is large in magnitude relative to the mean, then the data is more variable.

state impoundment - a body of standing water owned or leased and maintained by the Illinois Department of Conservation.

storage capacity - volume of water an impoundment can hold; often expressed in acre-feet, million gallons, and cubic meters.

submergent - an aquatic plant that lives and grows entirely below the surface of the water.

succession - in ecology, the progressive change of plant and animal life in an area.

suspended sediment - the sediment that at any given time is maintained in suspension by current or as a colloid.

suspended solids - particulate material that at any given time is maintained in suspension by current or as a colloid; total suspended solids are all suspended particular material, volatile and non-volatile, organic and inorganic; volatile suspended solids is that suspended particulate material, generally organic in nature, which undergoes combustion at a temperature of 600°C.

suspension - a heterogenous mixture in which the particles of one substance are kept dispersed by agitation.

thermal stratification - the layering of the water in a lake due to different densities as a function of temperature; the layers are the epilimnion (upper), metalimnion or thermocline (middle), and the hypolimnion (lower).

thermocline - metalimnion; the middle layer of water in a thermally stratified lake in which temperature decreases rapidly with increasing depth.

transparency - ability to allow light penetration and be seen through; clarity.

trophic state - the degree of eutrophication of a lake; the rate of primary biological production it is capable of supporting.

turbid - cloudy, opaque, murky, dirty-looking; containing suspensoids (organic or inorganic) which interfere with light penetration.

turbidity - amount of scattering of light caused by material suspended in the water.

use impairment - that which damages or negatively impacts the present or potential use of a body of water.

water quality - the suitability of the water for supporting various uses.

water retention time - water residence time; period of time a mass of water remains in an impoundment.

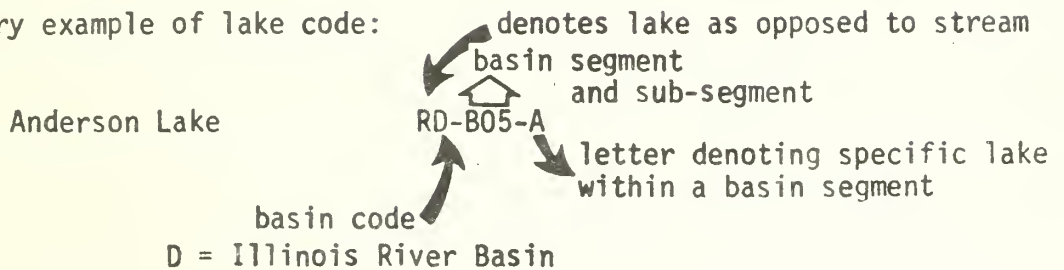
watershed - drainage area; the land surface surrounding the lake which contributes water, via surface runoff, to the lake; the total or contributing watershed area is the total draining to the lake, including the lake surface area; the immediate or net watershed is the portion of the total watershed (free of lakes or sloughs) from which direct, unimpeded surficial runoff drains to the lake.

zooplankton - animal portion of the community of suspended or floating organisms which drift passively with the water currents.

ABBREVIATIONS AND SYMBOLS

av - average
brn - brown
brnsh-grn - brownish-green
grn-brn - green-brown
grnsh-brn - greenish-brown
lt - light
max - maximum value
min - minimum value
mod - moderately
std. dev. - standard deviation
v - very

Explanatory example of lake code:



*Definitions of items in sense used in text

DS:sp,6207a,1-8

UNIVERSITY OF ILLINOIS-URBANA
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VOLUNTEER LAKE MONITORING PROGRAM SPRIN
1981:9



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MONITORING PROGRAM REPORT



BLACK OAK LAKE / LEECO.

1981 VOLUNTEER LAKE MONITORING PROGRAM REPORT
FOR
BLACK OAK LAKE, LEE COUNTY, ILLINOIS

A Cooperative Citizen -
Illinois Environmental Protection Agency
Project

May, 1982
Illinois Environmental Protection Agency
2200 Churchill Road
Springfield, Illinois 62706

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ACKNOWLEDGEMENTS

This is one of 87 reports prepared for lakes in the 1981 Volunteer Lake Monitoring Program. It represents the coordinated effort of many individuals.

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Reports were typed by Word Processing under the direction of Norma Kraus and Diane Woodyard while Field Observations and Lake Assessment Summaries were typed by Betty Pennington, Lori Whalen, Karen Janssen, and Marilyn Budd.

INTRODUCTION

A cooperative volunteer lake monitoring effort was initiated by the Illinois EPA in 1981 as part of an overall self-help, service program being developed for lakes. In addition to expanding the Agency's lakes data base with information on present water quality and trends, the program was designed to involve citizens in learning about a lake so they could make more informed decisions regarding its use, protection, and enhancement.

Citizens selected a lake they were concerned about and were trained to measure water clarity or transparency by recording the depth to which a Secchi disc (an eight-inch diameter metal plate painted black and white in alternating quadrants) was visible. They also measured total depth and recorded field observations from a boat at three sites on their chosen lake. Readings were to be taken twice a month from May through October and reported to the Agency on special data forms. The Secchi disc, data forms, and postage paid envelopes were provided by the Agency. Volunteers were required to have a boat with an anchor to perform the monitoring.

Approximately 140 volunteers participated in monitoring 87 lakes in 1981. The sampling data were computerized to facilitate analyses and preparation of tables and graphs for reports. A statewide report entitled "Volunteer Lake Monitoring, 1981", summarized all the data for the volunteer lakes. Individual reports were also prepared for each of the 87 lakes monitored by volunteers in 1981.

BACKGROUND

Black Oak Lake is a 6 acre impoundment owned by the Woodhaven Association. The lake, which is located in Lee County, 5 miles northwest of Sublette, Illinois, was constructed by damming an unnamed river in 1970. It has a maximum depth of 5 feet, an average depth of 2.5 feet and a storage capacity of 17 acre-feet (Table 1).

Black Oak Lake serves as a recreational lake with emphasis on fishing. Access is limited to organization members and their guests only.

The watershed drainage area of Black Oak Lake is estimated to be 65 percent residential. The lake shoreline is also primarily residential.

Suspended sediment and aquatic weeds are considered substantial problems in Black Oak Lake, while deposition of sediment is considered a moderate problem. Cropland runoff and sediment in the lake are cited as the major pollution source.

Assessment and monitoring information on Black Oak Lake was provided by Lisa Brooks, Aquatic Biologist. Secchi disc depth, total depth, and field observations were recorded at three sites (located in Figure 1).

TABLE 1. LAKE ASSESSMENT SUMMARY, BLACK OAK LAKE, LEE COUNTY, ILLINOIS (RP-A06-K).

I. GENERAL INFORMATION

River Basin: Rock
Segment: A06

Ownership: L.E. Lueder, Sr.-Gen.Mgr.-
Woodhaven Assoc.

Surface Area (Acres): 6.46

Watershed Area (Acres):

Maximum Depth (Feet): 5

Average Depth (Feet): 2.5

Storage Capacity (Acre/Feet): 17

Inflowing Stream(s):

Outflowing Stream(s):

Water Retention Time:

Lake Type: dammed stream

Year Constructed: 1970

II. USAGE

Public Access: no

Lake Usage:

Potable Water Supply: none

Industrial Water Supply: none

Agricultural Water Supply: none

Cooling Water: none

Recreation:

Fishing: very haeavy

Swimming: none

Power Boating: none

Row Boating or Canoeing: moderate

Sailboating: none

Camping: none

Picnicking: none

Waterfowl Hunting: none

Waterfowl Observation: none

Other:

Recreational Facilities:

picnic area

Shoreline Usage (Percent):

Urban (Including Streets): 10%

Residential (Including Lawns): 75%

Golf Courses:

Pasture or Grassland:

Woodland: 15%

Row Crops:

Wetland:

Other:

Watershed Usage (Percent):

Urban:

Residential: 65%

Golf Courses:

Pasture or Grassland: 10%

Woodland: 15%

Row Crops: 5%

Wetland:

Other:

III. WATER QUALITY AND PROBLEMS

General Water Quality: fair

Fishing: excellent

Conditions and Extent:

Suspended Sediment: large

Deposition of Sediment: moderate

Algal Blooms: minimal

Aquatic Weeds: large

Taste and/or Odor: minimal

Water Level Fluctuation: minimal

Fishkills: minimal

Other:

IV. CAUSES OF WATER QUALITY PROBLEMS

Potential Pollution Sources:

Sewage Treatment Plant Effluent:

Industrial Discharge:

Urban Storm Drainage:

Septic Tanks:

Pasture or Grassland Runoff:

Cropland Runoff: yes

Feedlot Runoff:

Construction Site Runoff:

Fertilizer or Pesticides from

Lawns/Golf Courses:

Orchards:

Forestry Operations Runoff:

Mining:

Waterfowl:

Sediment in Lake: yes

Other:

V. LAKE MANAGEMENT

Comments: Fall 1979 - Aerator installed; 6/80

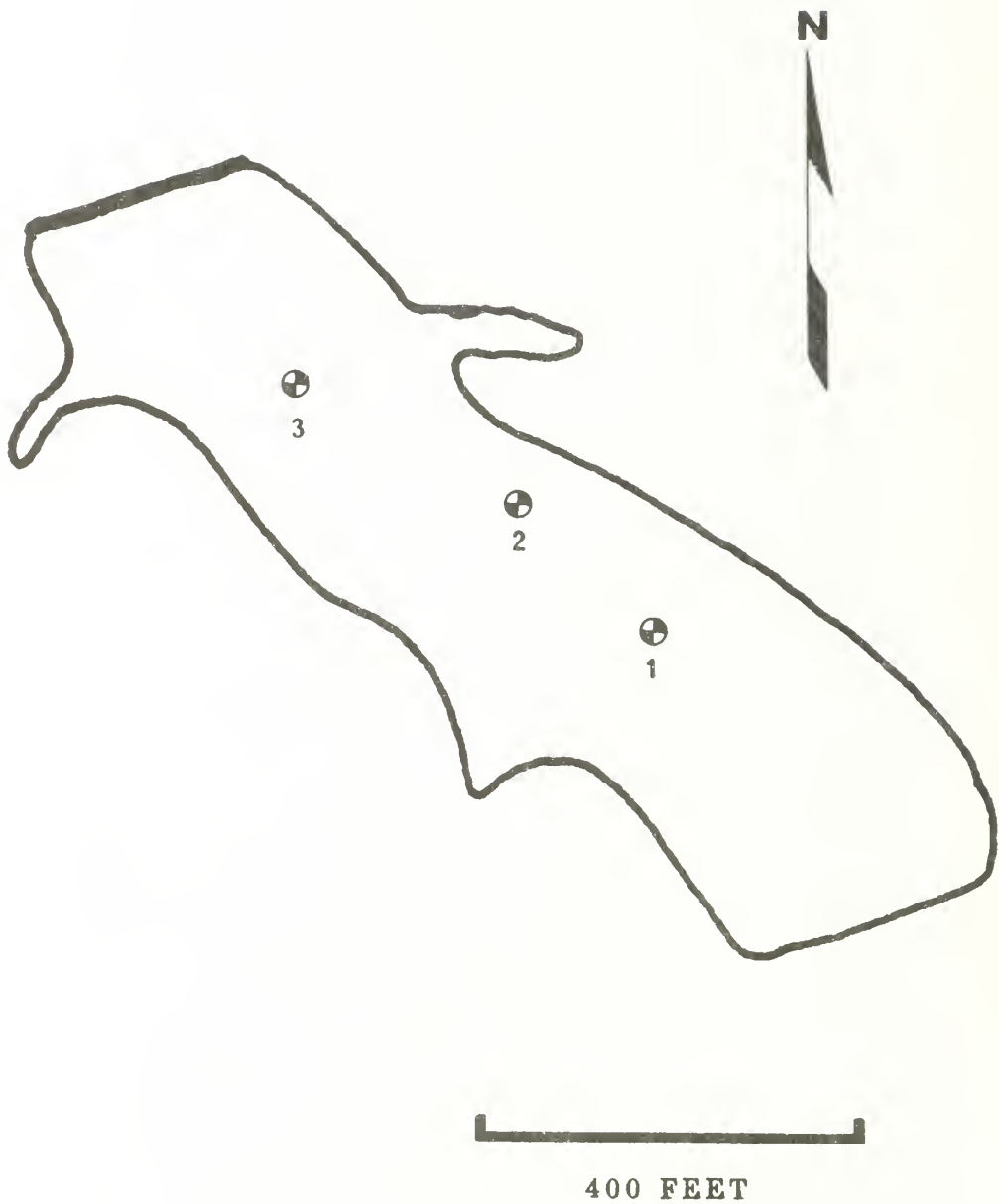
Aquathol-K to eliminate curly leaf pondweed form;

harvesting of aquatic weeds and stocking with

largemouth bass.

Information Supplied By Lisa Brooks (1981)

FIGURE 1
BLACK OAK LAKE
LEE COUNTY



RESULTS AND DISCUSSION

In this section, monitoring results will be presented for the lake and compared to those for other lakes in the volunteer program. Then spatial (within lake) and seasonal differences in transparency will be examined and related to field observations. Results will also be discussed in terms of lake uses. For an explanation of unfamiliar terms or concepts presented here, refer to the report "Volunteer Lake Monitoring, 1981", Section IV "Understanding Illinois' Lakes."

The Secchi monitoring data for Black Oak Lake are summarized in Table 2 and plotted in Figure 2. Total depth data are provided in Table 3, while field observations are summarized in Table 4.

Transparency of Black Oak Lake

The average Secchi disc transparency of Black Oak Lake was 49.0 inches which ranked number 22 when the average transparencies of the volunteer lakes were ranked from clearest (number 1 at 137.8 inches) to least transparent (number 87 at 7.3 inches). This average transparency was greater than the four feet minimum recommended for swimming by the Illinois Department of Public Health (1976) and was above average for Illinois lakes.

Spatial and Seasonal Differences in Transparency

Secchi disc readings for Black Oak Lake were taken on one date only, and were 48.0 inches at Site 1, 45.0 inches at Site 2 and 54.0 inches at Site 3. The Secchi values were almost equal to the total depths of the sites (5.0 feet, 4.0 feet and 5.5 feet at Sites 1, 2, and 3, respectively).

SUMMARY AND RECOMMENDATIONS

Summary

Black Oak Lake, a small, shallow recreational impoundment in northern Illinois, was sampled on May 31, 1981 under the Illinois EPA's Volunteer Lake Monitoring Program. Volunteer Lisa Brooks recorded Secchi disc transparency, total depth, and field observations at three sites and reported results to the Illinois EPA.

The average Secchi disc transparency of Black Oak Lake (49.0 inches) ranked 22nd of the 87 lakes monitored by volunteers in 1981 (rank 1 is clearest; 87 is least transparent). This average transparency was greater than the four feet minimum recommended for swimming by the Department of Public Health and was above average for Illinois lakes.

TABLE 2

SECCHI DISC TRANSPARENCY (INCHES): BLACK OAK/LEE COUNTY, ILLINOIS (VOLUNTEER DATA 1981)

DATE 05/ 31	SITE 1 48 0	SITE 2 45 0	SITE 3 54 0	MEAN 49 0	STD DEV 4 6
SUMMARY STATISTICS					
	LAKE				
SITES	48 0	45 0	54 0	49 0	
MEAN	-1 0	-1 0	-1 0	4 6	
STD DEV	48 0	45 0	54 0	45 0	
MIN	48 0	45 0	54 0	54 0	
MAX	5 0	4 0	5 5		
AV DEPTH					

-1 = missing value

See glossary for explanation of Summary Statistics

TABLE 3

DEPTH OF SITE (FEET) BLACK OAK/LEE COUNTY, ILLINOIS (VOLUNTEER DATA 1981)

DATE 05/ 31	SITE 1 5 0	SITE 2 4 0	SITE 3 5.5	MEAN 4.8	STD DEV 0 8
SUMMARY STATISTICS					
	LAKE				
SITES	5 0	4 0	5 5	4.8	
MEAN	-1 0	-1 0	-1 0	0 8	
STD DEV	5.0	4.0	5.5	4 0	
MIN	5.0	4.0	5.5	5 5	
MAX	5.0	4.0	5.5		
AV DEPTH					

-1 = missing value

See glossary for explanation of Summary Statistics.

FIGURE 2

SECCHI DISC TRANSPARENCY (INCHES) BLACK OAK/LEE COUNTY, ILLINOIS (VOLUNTEER DATA 1981)

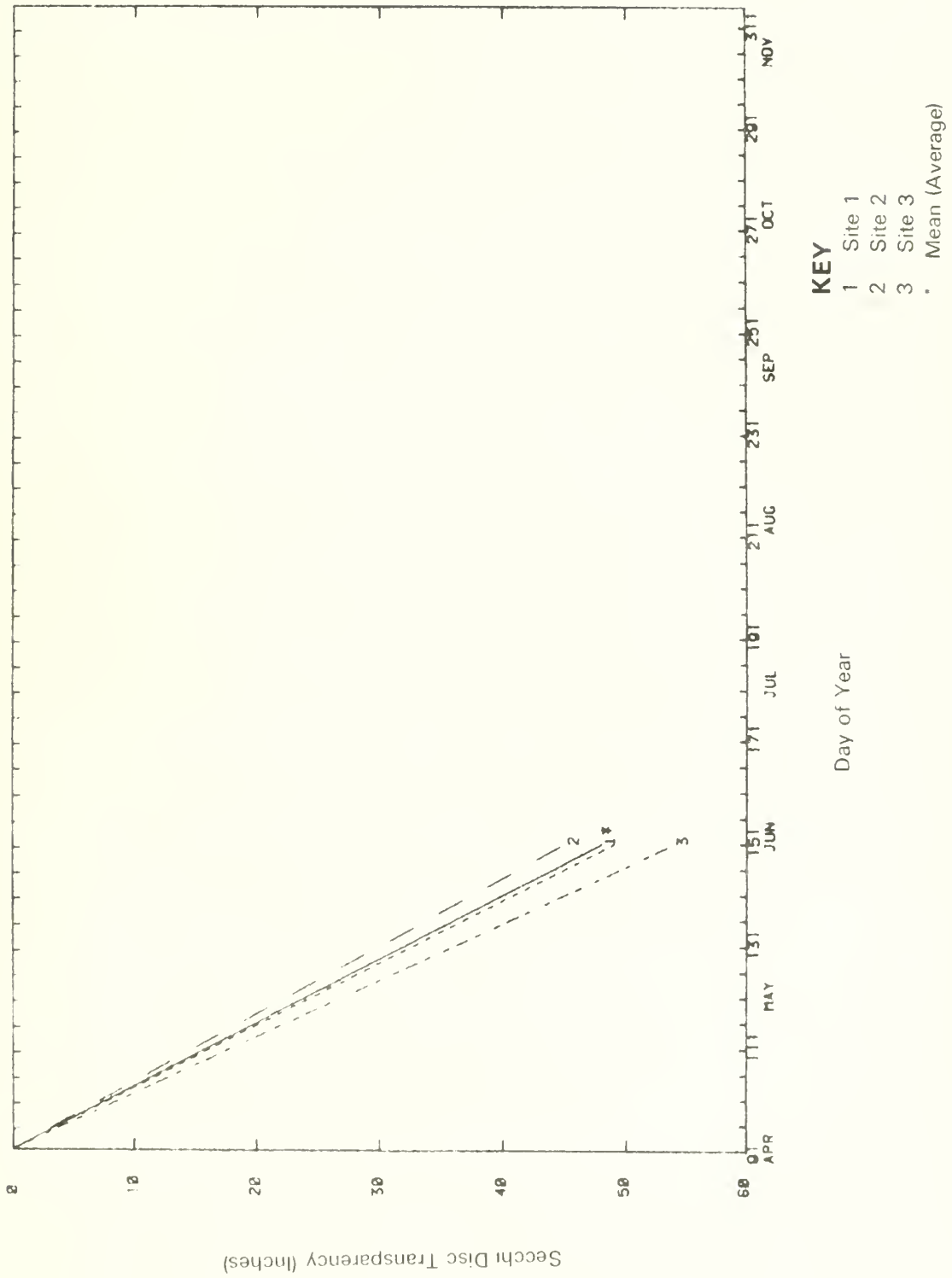


TABLE 4. FIELD OBSERVATIONS, BLACK OAK, LEE COUNTY, ILLINOIS

DATE	OBSERVATION	SITE 1	SITE 2	SITE 3	WEATHER AT LAKE	PRESENT	PRECEDING 24 HOURS	OTHER COMMENTS
5/15/81	WATER COLOR: SEDIMENT: ALGAE: WEEDS AT SAMPLE SITE: WEEDS NEAR SHORE: OTHER SUBSTANCES: ODOR:	brnsh-grn slight minimal large large none no odor	brnsh-grn slight minimal large large none no odor	brnsh-grn slight minimal large large none no odor	CLOUD COVER: PRECIPITATION: WAVES: AIR TEMPERATURE: WIND DIRECTION: OBSERVATIONS MADE BY:	few clouds no rain calm warm N Lisa Brooks	many clouds heavy rain ripple cool	WATER LEVEL OF LAKE: RECREATIONAL USAGE: LAKE MANAGEMENT: ADDITIONAL COMMENTS:
5/31/81	WATER COLOR: SEDIMENT: ALGAE: WEEDS AT SAMPLE SITE: WEEDS NEAR SHORE: OTHER SUBSTANCES: ODOR:	brnsh-grn minimal minimal large large none no odor	brnsh-grn minimal minimal large large none no odor	brnsh-grn minimal minimal large large none no odor	CLOUD COVER: PRECIPITATION: WAVES: AIR TEMPERATURE: WIND DIRECTION: OBSERVATIONS MADE BY:	clear no rain calm warm Lisa Brooks	clear no rain calm cool	WATER LEVEL OF LAKE: RECREATIONAL USAGE: LAKE MANAGEMENT: ADDITIONAL COMMENTS:
5/31/81	WATER COLOR: SEDIMENT: ALGAE: WEEDS AT SAMPLE SITE: WEEDS NEAR SHORE: OTHER SUBSTANCES: ODOR:				CLOUD COVER: PRECIPITATION: WAVES: AIR TEMPERATURE: WIND DIRECTION: OBSERVATIONS MADE BY:			WATER LEVEL OF LAKE: RECREATIONAL USAGE: LAKE MANAGEMENT: ADDITIONAL COMMENTS:
5/31/81	WATER COLOR: SEDIMENT: ALGAE: WEEDS AT SAMPLE SITE: WEEDS NEAR SHORE: OTHER SUBSTANCES: ODOR:				CLOUD COVER: PRECIPITATION: WAVES: AIR TEMPERATURE: WIND DIRECTION: OBSERVATIONS MADE BY:			WATER LEVEL OF LAKE: RECREATIONAL USAGE: LAKE MANAGEMENT: ADDITIONAL COMMENTS:

Black Oak Lake is undergoing the process of eutrophication, as evidenced by transparency readings and field observations of algae, weed, and sediment problems. Protection from further degradation is critical. If nutrient and sediment input were controlled, lake quality would probably improve; failure to control inputs will probably result in continued rapid eutrophication. Lake managers should identify sources of nutrient and sediment input and take steps to control them before the lake becomes further degraded.

Recommendations

Developing a management plan for a lake requires a comprehensive assessment of the lake and watershed and is beyond the scope of this project. However, some suggestions regarding lake management are presented below for consideration; their applicability to this lake would require further study. Alternative options not presented here may also apply.

Information on lake water levels is important for determining lake management strategies. Installation of a simple, but accurate, water level measuring device and frequent recording of lake water levels is recommended.

Lake managers should work with the Soil and Water Conservation District and the Soil Conservation Service to develop a procedure to identify and quantify non-point pollution source areas. This procedure should allow for the targeting of resources and programs to correct the identified problems.

Installation of Resource Management Systems in source areas of the watershed may reduce nutrient and sediment transport to the lake. Stabilization of the lake shoreline by riprap or some other means may also reduce sediment input. Nutrient contributions from septic tanks, fertilization of lawns, and waterfowl should also be investigated and minimized. Continuation of the present in-lake management program, including aeration and weed harvesting, may prove beneficial.

Continued monitoring is recommended for Black Oak Lake. Consistent data gathered over a period of years is necessary to document and evaluate water quality trends, identify problems, and evaluate lake/watershed management strategies.

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DS:jab/sp3871C

GLOSSARY*

acre-foot - the volume of water required to cover one acre to a depth of one foot and equal to 0.3258 million gallons; a unit of storage capacity obtained by multiplying surface area (in acres) by average depth (in feet).

aeration-destratification - the addition of air to the water through mechanical means to increase the dissolved oxygen content of the bottom waters of lakes by eliminating thermal stratification and homogenizing the entire water column.

aerobic - conditions characterized by the presence of oxygen.

algae - one-celled or colonial photosynthetic plants (usually microscopic), found suspended in water or attached to damp rocks or other substrates.

algal bloom - a large number of planktonic algae, which often turns the water green and may produce objectionable scums and odors; a condition in which algae cloud the water noticeably.

ambient - existing condition or level at the time and place.

ammonia - a colorless, gaseous, alkaline compound which is a decompositional end product of nitrogen-containing organic matter; its importance in fresh water is associated with its toxicity to aquatic organisms and its use as a nutrient for aquatic plant growth.

anaerobic - conditions characterized by the absence of oxygen.

anoxic - without oxygen.

aquatic - growing or living in water; pertaining to water.

aquatic weeds - larger plants easily visible to the naked eye which are submergent, floating or emergent in the water.

artificial - man-made; constructed.

average depth - mean depth of a lake, calculated by dividing the volume (storage capacity) by the surface area.

backwater (or river backwater) - water impoundment located along the side of a stream or river which may flood periodically or have a direct connection to the stream at all times.

blue-green algae - a group of one celled or colonial plants of the phylum Cyanophyta, which live in water or damp places and reflect a blue to dark green tint; most often responsible for nuisance algal blooms with scum and odors.

borrow pit - a water impoundment formed by removal of earth for fill construction in the making of roads, dikes, bridges and levees

bottomland lake - natural water impoundment located in a river floodplain

circulation period - mixing period for a lake; period of time in which the entire lake volume is not thermally stratified and is totally mixed by wind action.

condition - the overall quality of the lake for supporting general use

detritus - finely divided organic and inorganic settleable material suspended in the water

diatoms - a group of one-celled or colonial algae living in water or damp places which are characterized by the presence of yellow-green or brown pigments and cell walls which contain silica and are composed of two halves (valves), one overlapping the other like the top and bottom of a pill box

drainage area - watershed; the land surface surrounding the lake which contributes water via surface runoff to the lake

ecology - the study of the relationship of organisms to their environment

emergent - a rooted aquatic plant with parts normally extending above the water surface

epilimnion - upper, relatively warm, circulating zone of water in a thermally stratified lake

euphotic zone - region of a lake where light penetration is sufficient to maintain photosynthesis; its lower limit is generally two to five times the Secchi disc transparency.

eutrophic - waters which are rich in plant nutrients and capable of supporting high biological productivity; USEPA defines a eutrophic lake as one that exhibits any of the following characteristics: biomass accumulations of primary producers (algal blooms and excessive aquatic weeds); rapid organic or inorganic sedimentation and shallowing; or seasonal dissolved oxygen deficiencies in the bottom waters and subsequent shift in species composition of aquatic fauna to forms that can tolerate lower concentrations of oxygen.

eutrophication - lake aging through nutrient enrichment and sedimentation.

fertile - waters rich in plant nutrients.

glacial lake - body of standing water formed by glacial action.

green algae - a group of one-celled or colonial plants of the phylum Chlorophyta, which live in water or damp areas and reflect a greenish tint.

hydrogen sulfide - a gaseous compound produced under anaerobic conditions which has a rotten egg smell.

hypolimnion - lower, relatively cold, noncirculating zone in a thermally stratified lake.

impairment - that which damages or negatively impacts the present or potential use of a body of water.

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mixing period - circulation period of a lake; period of time in which the lake is not thermally stratified and is totally mixed by wind action.

nitrogen - an element which is an essential plant nutrient and is one of the principal elemental constituents of proteins.

nonpoint pollution - pollution from diffuse sources (e.g., agriculture, forestry operations, mining, construction) for which a specific point of discharge cannot be readily identified.

nutrient - any chemical element, ion or compound that is required by an organism for the continuation of growth, reproduction and other life processes; nitrogen and phosphorus are usually growth limiting factors for aquatic plants.

oligotrophic - waters with low concentrations of plant nutrients and hence capable of supporting little biological productivity.

organizational impoundment - body of standing water owned, leased or maintained by an organization of six or more members (as defined by the Illinois Department of Conservation).

phosphorus - an element which is an essential plant nutrient and plays a vital role in the energy transfer during cell metabolism.

photosynthesis - the process by which green plants use the sun's energy to convert dioxide and water into chemical energy (carbohydrates, fats, and proteins).

phytoplankton - microscopic plants (algae) that drift passively in open water regions of lakes and rivers.

plankton - the community of microscopic plants and animals that drift passively in open water regions of lakes and rivers.

point source pollution - pollution emanating from a discharge point such as a pipe which can be specifically identified (e.g., sewage treatment plants, manufacturing plants).

pollution - any substance which makes another unclean or impure.

pond - small body of standing water less than 6.0 acres in surface area (as defined by the Illinois Department of Conservation).

potable - of quality for drinking.

private impoundment - body of standing water privately owned or leased with no fee charged for use (as defined by the Illinois Department of Conservation).

production - total amount of living matter produced in a lake per unit time.

productivity - rate at which organic material (and energy) is produced and transferred through organisms in an ecosystem; standing crop of organisms that can be supported.

protection - pollution abatement or control; measures to prevent pollution from entering a lake, including methods to stop the pollution at its source or to treat it before it reaches the lake.

public access - publicly owned contiguous land or easements providing any member of the public the same or equivalent opportunity to enjoy privileges and benefits of the lake as any other member of the public or as any resident around the lake.

public impoundment - body of standing water owned and maintained by a governmental agency (excluding the Illinois Department of Conservation) that have public access.

public water supply - used as a municipal water supply for domestic needs.

Resource Management Systems - best management practices for the control and abatement of nonpoint pollution; a combination of agricultural practices which reduce soil erosion and/or increase water retention.

restoration - structural measures designed to return a lake to its original condition (e.g., dredging to original depth).

reservoir - a watershed impoundment artificially constructed by damming of a stream.

resuspend - cause to be suspended in the water.

river basin - drainage area for a large river.

seasonal - over a period of time (seasonal).

Secchi disc - an eight-inch diameter weighted metal plate painted black and white in alternating quadrants which is lowered into the water on a calibrated line to measure the transparency or clarity of the water.

Secchi disc depth - the depth into the water to which a black and white circular disc can be seen when viewed from the surface; a measure of water transparency or its ability to allow vertical light penetration.

sediment - the solid materials (particulate matter) transported by, suspended in or deposited from, water; includes fragmentary material that originates from weathering of rock, chemical and biochemical precipitants and decomposed organic material such as humus.

sediment-related turbidity - muddiness; cloudiness or opaqueness of the water caused by suspended sediment.

sedimentation - deposition of organic and/or inorganic particulate matter.

sedimentation surveys - measurement of the amount of sediment deposited in a water body.

segments - a subwatershed within a large river basin.

spatial - differences over an area.

standard deviation (Std. Dev.) - a statistical term to describe the variability of the data around the mean (average); if the magnitude of the standard deviation is "small" relative to the mean, then most of the values are close to the mean in magnitude and the data has little variability (is relative uniform); if the standard deviation is large in magnitude relative to the mean, then the data is more variable.

state impoundment - a body of standing water owned or leased and maintained by the Illinois Department of Conservation.

storage capacity - volume of water an impoundment can hold; often expressed in acre-feet, million gallons, and cubic meters.

submergent - an aquatic plant that lives and grows entirely below the surface of the water.

succession - in ecology, the progressive change of plant and animal life in an area.

suspended sediment - the sediment that at any given time is maintained in suspension by current or as a colloid.

suspended solids - particulate material that at any given time is maintained in suspension by current or as a colloid; total suspended solids are all suspended particular material, volatile and non-volatile, organic and inorganic; volatile suspended solids is that suspended particulate material, generally organic in nature, which undergoes combustion at a temperature of 600°C.

suspension - a heterogenous mixture in which the particles of one substance are kept dispersed by agitation.

thermal stratification - the layering of the water in a lake due to different densities as a function of temperature; the layers are the epilimnion (upper), metalimnion or thermocline (middle), and the hypolimnion (lower).

thermocline - metalimnion; the middle layer of water in a thermally stratified lake in which temperature decreases rapidly with increasing depth.

transparency - ability to allow light penetration and be seen through; clarity.

trophic state - the degree of eutrophication of a lake; the rate of primary biological production it is capable of supporting.

turbid - cloudy, opaque, murky, dirty-looking; containing suspensoids (organic or inorganic) which interfere with light penetration.

turbidity - amount of scattering of light caused by material suspended in the water.

use impairment - that which damages or negatively impacts the present or potential use of a body of water.

water quality - the suitability of the water for supporting various uses.

water retention time - water residence time; period of time a mass of water remains in an impoundment.

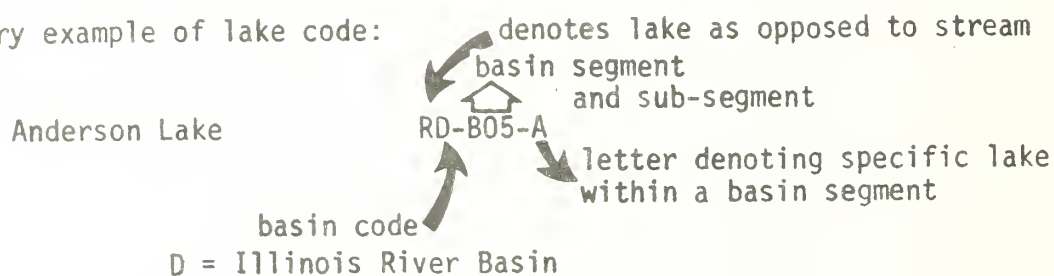
watershed - drainage area; the land surface surrounding the lake which contributes water, via surface runoff, to the lake; the total or contributing watershed area is the total draining to the lake, including the lake surface area; the immediate or net watershed is the portion of the total watershed (free of lakes or sloughs) from which direct, unimpeded surficial runoff drains to the lake.

zooplankton - animal portion of the community of suspended or floating organisms which drift passively with the water currents.

ABBREVIATIONS AND SYMBOLS

av - average
brn - brown
brnsh-grn - brownish-green
grn-brn - green-brown
grnsh-brn - greenish-brown
lt - light
max - maximum value
min - minimum value
mod - moderately
std. dev. - standard deviation
v - very

Explanatory example of lake code:



*Definitions of items in sense used in text

DS:sp,6207a,1-8

UNIVERSITY OF ILLINOIS-URBANA
551 482V889X C002
VOLUNTEER LAKE MONITORING PROGRAM SPRIN
1981.8



3 0112 017526119

551.482
V889x
1981:7
Cg. 2

Nat. Hist. Surv.

ILLINOIS ENVIRONMENTAL PROTECTION AGENCY
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SPRINGFIELD, ILLINOIS 62706



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MONITORING PROGRAM REPORT



BENJON LAKE / FRANKLIN CO.

1981 VOLUNTEER LAKE MONITORING PROGRAM REPORT
FOR
BENTON LAKE, FRANKLIN COUNTY, ILLINOIS

A Cooperative Citizen-
Illinois Environmental Protection Agency
Project

May, 1982
Illinois Environmental Protection Agency
2200 Churchill Road
Springfield, Illinois 62706

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INTRODUCTION

A cooperative volunteer lake monitoring effort was initiated by the Illinois EPA in 1981 as part of an overall self-help, service program being developed for lakes. In addition to expanding the Agency's lakes data base with information on present water quality and trends, the program was designed to involve citizens in learning about a lake so they could make more informed decisions regarding its use, protection, and enhancement.

Citizens selected a lake they were concerned about and were trained to measure water clarity or transparency by recording the depth to which a Secchi disc (an eight-inch diameter metal plate painted black and white in alternating quadrants) was visible. They also measured total depth and recorded field observations from a boat at three sites on their chosen lake. Readings were to be taken twice a month from May through October and reported to the Agency on special data forms. The Secchi disc, data forms, and postage paid envelopes were provided by the Agency. Volunteers were required to have a boat with an anchor to perform the monitoring.

Approximately 140 volunteers participated in monitoring 87 lakes in 1981. The sampling data were computerized to facilitate analyses and preparation of tables and graphs for reports. A statewide report entitled, "Volunteer Lake Monitoring, 1981", summarized all the volunteer data. Individual reports were also prepared for each of the 87 lakes monitored by volunteers in 1981.

BACKGROUND

Benton Lake is a 37 acre impoundment owned by the City of Benton, Franklin County, Illinois. The impoundment, which was constructed by the WPA in 1937 by damming of an unnamed creek, has a maximum depth of 23 feet, an average depth of 6 feet and a storage capacity of 222 acre-feet (Table 1). Hamilton Lake, located immediately upstream of Benton Lake serves as a sediment trap for it.

Benton Lake serves as a recreational lake, with heavy use for fishing, swimming, power boating, waterskiing, and picnicking. Row-boating and canoeing and waterfowl observation are moderate uses. Benton Lake was formerly the potable water supply for the City before Rend Lake was constructed. Access is unlimited and free.

The watershed drainage area of Benton Lake is estimated to be 50% residential, 20% pasture or grassland and 20% woodland. The lake shoreline is primarily residential.

TABLE 1. LAKE ASSESSMENT SUMMARY, BENTON LAKE, FRANKLIN COUNTY, ILLINOIS (RN-B01-0).

I. GENERAL INFORMATION

River Basin: Big Muddy
Segment: B01

Ownership:

Surface Area (Acres): 37
Watershed Area (Acres): 640
Maximum Depth (Feet): 23
Average Depth (Feet): 6
Storage Capacity (Acre/Feet): 222
Inflowing Stream(s): none
Outflowing Stream(s):
Water Retention Time:
Lake Type: man-made
Year Constructed: 1937

II. USAGE

Public Access: yes

Lake Usage:

Potable Water Supply: none
Industrial Water Supply: none
Agricultural Water Supply: light
Cooling Water: none
Recreation: heavy
Fishing: heavy
Swimming: heavy
Power Boating: heavy
Row Boating or Canoeing: moderate
Sailboating: light
Camping: light
Picnicking: heavy
Waterfowl Hunting: none
Waterfowl Observation: moderate
Other: waterskiing: heavy

Recreational Facilities:

boat launch & cabins

Shoreline Usage (Percent):

Urban (Including Streets): 2%
Residential (Including Lawns): 80%
Golf Courses:
Pasture or Grassland: 5%
Woodland: 10%
Row Crops: 3%
Wetland:
Other:

Watershed Usage (Percent):

Urban:
Residential: 50%
Golf Courses:
Pasture or Grassland: 20%
Woodland: 20%
Row Crops: 5%
Wetland: 5%
Other:

III. WATER QUALITY AND PROBLEMS

General Water Quality: good

Fishing: good

Conditions and Extent:

Suspended Sediment: moderate
Deposition of Sediment: moderate
Algal Blooms: moderate
Aquatic Weeds: moderate
Taste and/or Odor: moderate
Water Level Fluctuation: slight
Fishkills: minimal
Other:

IV. CAUSES OF WATER QUALITY PROBLEMS

Potential Pollution Sources:

Sewage Treatment Plant Effluent:
Industrial Discharge:
Urban Storm Drainage:
Septic Tanks: yes
Pasture or Grassland Runoff: yes
Cropland Runoff: yes
Feedlot Runoff:
Construction Site Runoff: yes
Fertilizer or Pesticides from
Lawns/Golf Courses: yes
Orchards:
Forestry Operations Runoff:
Mining:
Waterfowl: yes
Sediment in Lake: yes
Other: oil wells

V. LAKE MANAGEMENT

Comments: May 1, 1981 - Copper sulfate treatment
to control aquatic weed growth, approximately 200-
300 lbs. drug in burlap bags behind boat.

Information Supplied By Leonard Hopkins (1981)

Suspended sediment, deposition of sediment, algal blooms, aquatic weeds and taste and odor are considered moderate problems. Septic tanks, pasture, grassland, cropland and construction site runoff, fertilizer or pesticides from lawns/golf courses, waterfowl, sediment in the lake and oil wells are cited as potential pollution sources.

Assessment and monitoring information on Benton Lake was provided by Leonard Hopkins. Secchi disc depth, total depth, and field observations were recorded at three sites (located in Fig. 1) on seven dates in 1981: May 16 and 22, June 28, July 12 and 26, August 16, and October 25.

RESULTS AND DISCUSSION

In this section, monitoring results will be presented for the lake and compared to those for other lakes in the volunteer program. Then spatial (within lake) and seasonal differences in transparency will be examined and related to field observations. Results will also be discussed in terms of lake uses. For an explanation of unfamiliar terms or concepts presented here, refer to the report, "Volunteer Lake Monitoring, 1981", Section IV, "Understanding Illinois' Lakes."

The Secchi monitoring data for Benton Lake are summarized in Table 2 and plotted in Fig. 2. Total depth data are provided in Table 3, while field observations are summarized in Table 4.

Transparency of Benton Lake

The average Secchi disc transparency of Benton Lake was 26.7 inches, which ranked 50th when the average transparencies of the volunteer lakes were ranked from clearest (number 1 at 137.8 inches) to least transparent (number 87 at 7.3 inches). This average transparency was less than the four feet minimum recommended for swimming by the Illinois Department of Public Health (1976), but was in the normal range for Illinois lakes and compatible with most recreational uses.

Spatial and Seasonal Differences in Transparency

The Secchi disc transparency of Benton Lake ranged from a maximum of 42 inches at Site 2 on May 16 to a minimum of 15 inches at Site 3 on July 12 and August 16.

Differences in clarity were evident in different sections of Benton Lake. Transparency averaged 26.0 inches, 30.0 inches, and 24.0 inches at Sites 1, 2, and 3 respectively. Readings at all three sites were less than the four feet minimum recommended for swimming on all sampling dates.

FIGURE 1

BENTON LAKE

FRANKLIN COUNTY

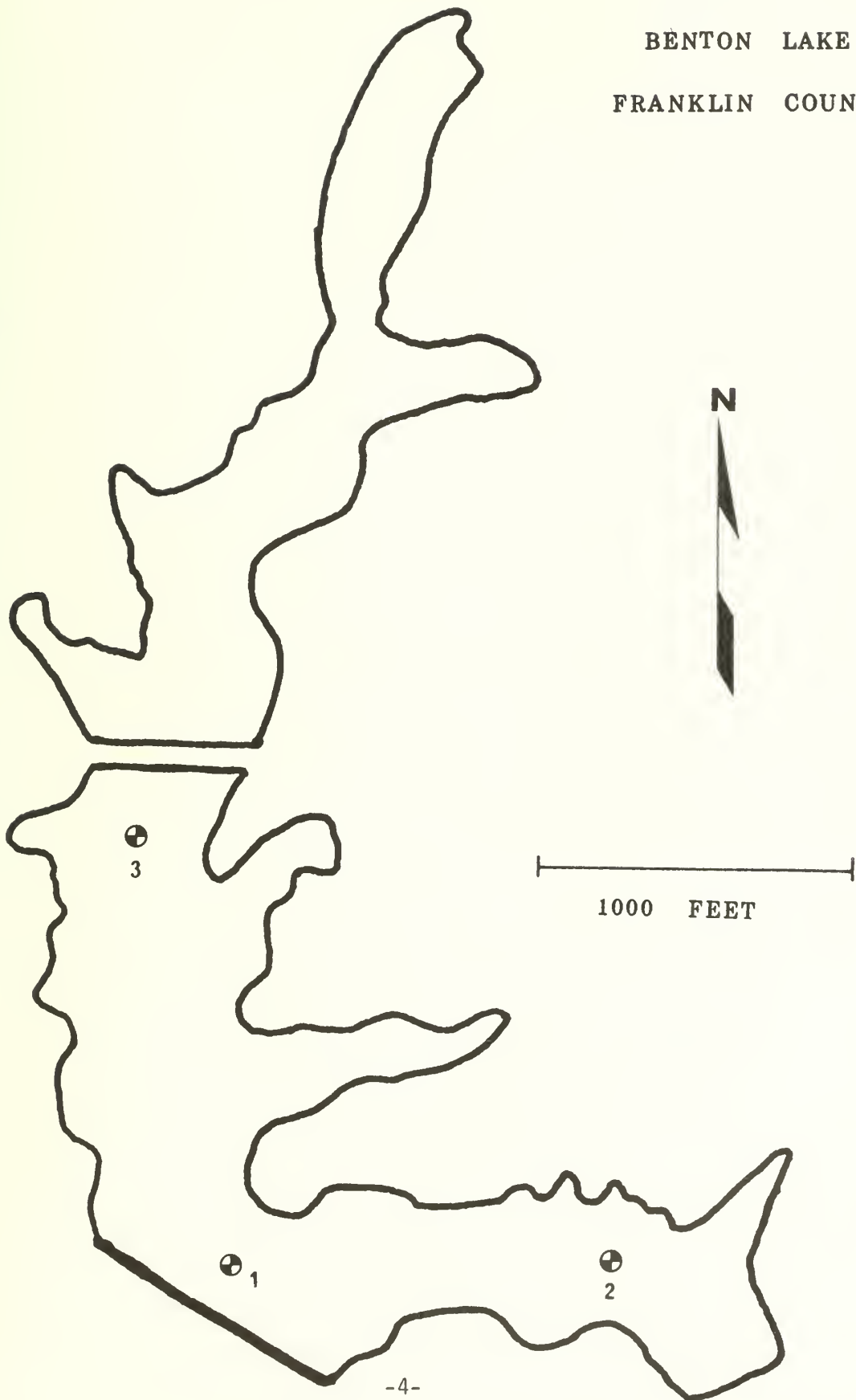


TABLE 2

SECCH) DISC TRANSPARENCY (INCHES) BENTON/FRANKLIN COUNTY, ILLINOIS (VOLUNTEER DATA 1981)

DATE	SITE 1	SITE 2	SITE 3	MEAN	STD DEV
85/ 16	34.0	42.0	30.0	35.3	6.1
85/ 22	20.0	30.0	30.0	20.3	1.2
86/ 28	27.0	36.0	30.0	31.0	4.6
87/ 12	18.0	21.0	15.0	18.0	3.0
87/ 26	24.0	30.0	24.0	26.0	3.5
88/ 16	18.0	21.0	15.0	18.0	3.0
89/ 25	33.0	30.0	24.0	29.0	4.6

SUMMARY STATISTICS

SITES	LAKE
MEAN	26.0
STD DEV	6.5
MIN	18.0
MAX	34.0
AV DEPTH	13.1

-1 = missing value

See glossary for explanation of Summary Statistics

TABLE 3

DEPTH OF SITE (FEET) BENTON/FRANKLIN COUNTY, ILLINOIS (VOLUNTEER DATA 1981)

DATE	SITE 1	SITE 2	SITE 3	MEAN	STD DEV
85/ 16	10.0	15.5	7.5	11.0	4.1
85/ 22	16.0	14.5	7.0	12.5	4.8
86/ 28	12.5	18.5	8.0	13.0	5.3
87/ 12	12.0	18.5	7.5	12.7	5.5
87/ 26	13.0	10.0	7.0	13.0	6.0
88/ 16	13.0	18.5	8.0	13.2	5.3
89/ 25	15.0	15.0	8.0	12.7	4.0

SUMMARY STATISTICS

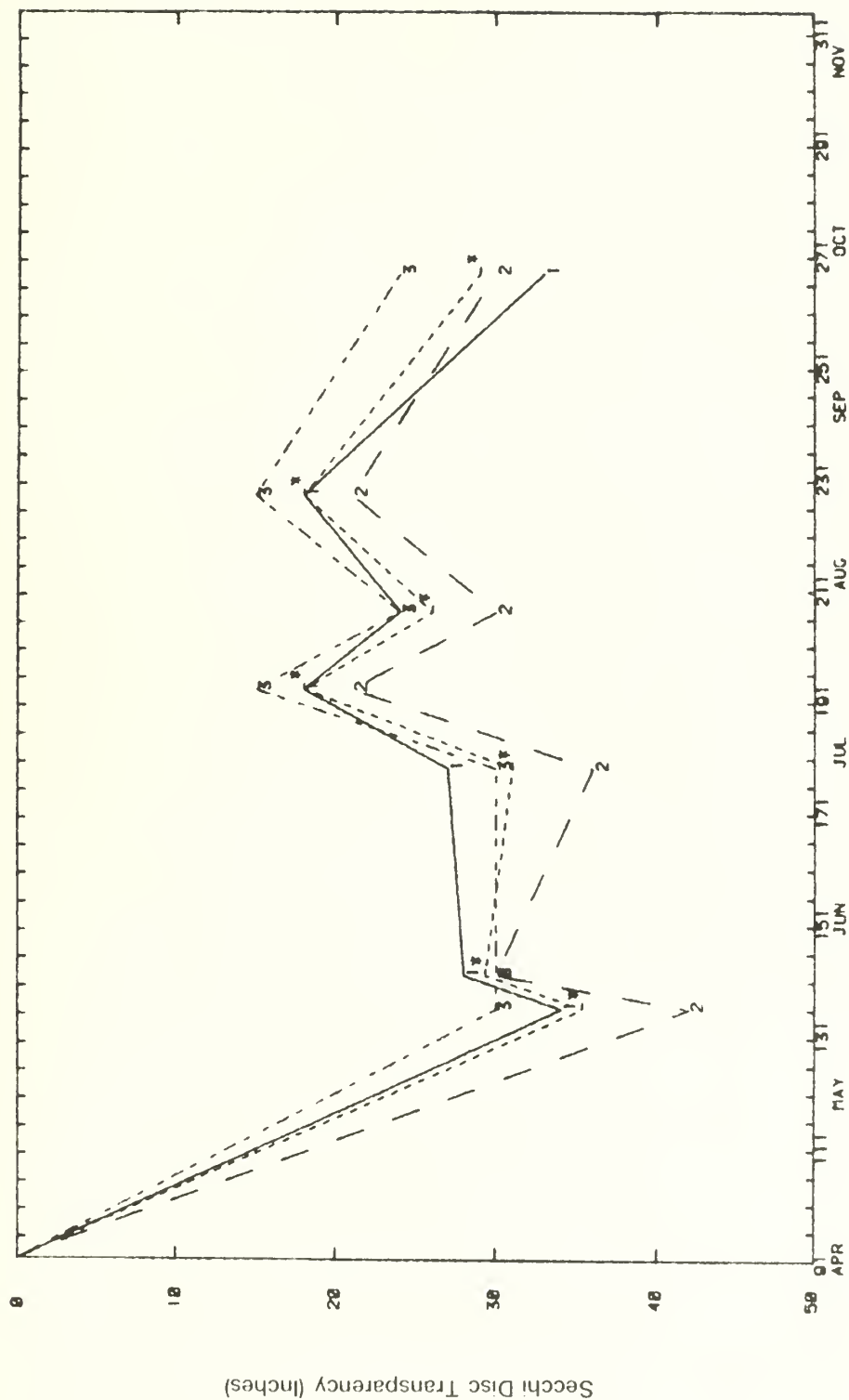
SITES	LAKE
MEAN	13.1
STD DEV	2.0
MIN	10.0
MAX	16.0
AV DEPTH	13.1

-1 = missing value

See glossary for explanation of Summary Statistics

FIGURE 2

SECCHI DISC TRANSPARENCY (INCHES) BENTON/FRANKLIN COUNTY, ILLINOIS (VOLUNTEER DATA 1981)



KEY
 1 Site 1
 2 Site 2
 3 Site 3
 . Mean (Average)

TABLE 4. FIELD OBSERVATIONS, BENTON LAKE, FRANKLIN COUNTY, ILLINOIS.

DATE	OBSERVATION	SITE 1	SITE 2	SITE 3	WEATHER AT LAKE	PRESENT	PRECEDING 24 HOURS	OTHER COMMENTS
5/16/81	WATER COLOR: SEDIMENT: ALGAE: WEEDS AT SAMPLE SITE: WEEDS NEAR SHORE: OTHER SUBSTANCES: ODOR:	grn-brn slight minimal slight moderate waterfowl no odor	grn-brn slight minimal minimal minimal none no odor	grn-brn slight minimal slight moderate none fishy	CLOUD COVER: PRECIPITATION: WAVES: AIR TEMPERATURE: WIND DIRECTION:	clear no rain calm hot SW	few clouds no rain calm warm S-SW	WATER LEVEL OF LAKE: normal RECREATIONAL USAGE: fishing, power boating, row boating/ canoeing, picnicking LAKE MANAGEMENT: 5/1/81 1st. sampling copper sulfate 200-300# for aquatic weeds. ADDITIONAL COMMENTS:
5/22/81	WATER COLOR: SEDIMENT: ALGAE: WEEDS AT SAMPLE SITE: WEEDS NEAR SHORE: OTHER SUBSTANCES: ODOR:	grn-brn moderate minimal minimal moderate none no odor	grn-brn moderate minimal minimal slight none no odor	grn-brn moderate minimal minimal moderate none no odor	CLOUD COVER: PRECIPITATION: WAVES: AIR TEMPERATURE: WIND DIRECTION:	few clouds no rain small warm SW	many clouds mod. rain moderate warm W-NW	WATER LEVEL OF LAKE: above normal 8" RECREATIONAL USAGE: fishing, row boating/canoeing, picnicking LAKE MANAGEMENT: none ADDITIONAL COMMENTS:
6/28/81	WATER COLOR: SEDIMENT: ALGAE: WEEDS AT SAMPLE SITE: WEEDS NEAR SHORE: OTHER SUBSTANCES: ODOR:	grnsh-brn moderate large slight algal col. waterfowl musty	grnsh-brn moderate large minimal algal col. waterfowl musty	grnsh-brn moderate large moderate algal col. waterfowl musty	CLOUD COVER: PRECIPITATION: WAVES: AIR TEMPERATURE: WIND DIRECTION:	hazy no rain ripple hot SW	clear v. lt. rain ripple hot SW	WATER LEVEL OF LAKE: normal RECREATIONAL USAGE: fishing, power boating, waterskiing, row boating/ canoeing, picnicking LAKE MANAGEMENT: ADDITIONAL COMMENTS:
7/12/81	WATER COLOR; SEDIMENT; ALGAE; WEEDS AT SAMPLE SITE: WEEDS NEAR SHORE: OTHER SUBSTANCES: ODOR:	grnsh-brn moderate moderate minimal slight algal col. waterfowl no odor	grnsh-brn moderate slight minimal minimal algal col. waterfowl no odor	grnsh-brn moderate slight minimal slight algal col. waterfowl no odor	CLOUD COVER: PRECIPITATION: WAVES: AIR TEMPERATURE: WIND DIRECTION:	hazy no rain ripple hot SW	many clouds mod. rain moderate hot W	WATER LEVEL OF LAKE: above normal 6" RECREATIONAL USAGE: fishing, swimming, power boating, waterskiing, row boating/ canoeing, picnicking LAKE MANAGEMENT: ADDITIONAL COMMENTS:

TABLE 4. FIELD OBSERVATIONS, BENTON LAKE, FRANKLIN COUNTY, ILLINOIS

DATE	OBSERVATION	SITE 1	SITE 2	SITE 3	WEATHER AT LAKE	PRESENT	PRECEDING 24 HOURS	OTHER COMMENTS
7/26/81	WATER COLOR: SEDIMENT: ALGAE: WEEDS AT SAMPLE SITE: WEEDS NEAR SHORE: OTHER SUBSTANCES: ODOR:	grnsh-brn slight large minimal slight algal col. waterfowl no odor	grnsh-brn slight moderate minimal minimal algal col. waterfowl no odor	grnsh-brn slight moderate minimal slight algal col. waterfowl no odor	CLOUD COVER: PRECIPITATION: WAVES: AIR TEMPERATURE: WIND DIRECTION:	clear no rain calm hot SW	many clouds mod. rain moderate hot W	WATER LEVEL OF LAKE: above normal 6" RECREATIONAL USAGE: fishing, swimming, power boating, waterskiing, row boating/ canoeing, picnicking LAKE MANAGEMENT: ADDITIONAL COMMENTS: Lake needs copper sulfate treatment.

DATE	OBSERVATION	SITE 1	SITE 2	SITE 3	WEATHER AT LAKE		PRECEDING 24 HOURS	OTHER COMMENTS
8/16/81	WATER COLOR: SEDIMENT: ALGAE: WEEDS AT SAMPLE SITE: WEEDS NEAR SHORE: OTHER SUBSTANCES: ODOR:	grn-brn minimal large minimal slight waterfowl *	grn-brn minimal moderate minimal minimal * algae	grn-brn minimal large minimal moderate * algae	CLOUD COVER: PRECIPITATION: WAVES: AIR TEMPERATURE: WIND DIRECTION:	clear no rain calm very hot SW	clear no rain calm very hot SW	WATER LEVEL OF LAKE: normal RECREATIONAL USAGE: fishing, swimming, power boating, waterskiing, row boating/ canoeing, picnicking LAKE MANAGEMENT: ADDITIONAL COMMENTS: Much algae growth

*algal mats & algal col.

DATE	OBSERVATION	PRECEDING 24 HOURS			OTHER COMMENTS
		SITE 1	SITE 2	SITE 3	
9/25/81	<p>WATER COLOR: grnsh-brn</p> <p>SEDIMENT: moderate</p> <p>ALGAE: minimal</p> <p>WEEDS AT SAMPLE SITE: slight</p> <p>WEEDS NEAR SHORE: waterfowl</p> <p>OTHER SUBSTANCES: fishy</p> <p>ODOR: fishy</p>	<p>grnsh-brn</p> <p>slight</p> <p>moderate</p> <p>minimal</p> <p>slight</p> <p>waterfowl</p> <p>fishy</p>	<p>grnsh-brn</p> <p>moderate</p> <p>moderate</p> <p>minimal</p> <p>moderate</p> <p>waterfowl</p> <p>fishy</p>	<p>cloud cover: clear</p> <p>precipitation: no rain</p> <p>waves: clam</p> <p>air temperature: cool</p> <p>wind direction: S.W.</p> <p>few clouds</p> <p>v.l.t. rain</p> <p>ripple</p> <p>cool</p> <p>S.W.</p>	<p>WATER LEVEL OF LAKE: normal</p> <p>RECREATIONAL USAGE: fishing, row boating</p> <p>canoeing</p> <p>LAKE MANAGEMENT: none</p> <p>ADDITIONAL COMMENTS: none</p>

DATE	OBSERVATION	SITE 1	SITE 2	SITE 3	WEATHER AT LAKE	PRESENT	PRECEDING 24 HOURS	OTHER COMMENTS
	WATER COLOR; SEDIMENT; ALGAE; WEEDS AT SAMPLE SITE; WEEDS NEAR SHORE; OTHER SUBSTANCES; ODOR:				CLOUD COVER: PRECIPITATION: WAVES: AIR TEMPERATURE: WIND DIRECTION: OBSERVATIONS MADE BY:			WATER LEVEL OF LAKE: RECREATIONAL USAGE: LAKE MANAGEMENT: ADDITIONAL COMMENTS:

There were seasonal differences in the transparency of Benton Lake. Lowest transparencies were generally recorded in midsummer, and were probably the result of algal blooms.

Field observations of water color and amount of algae and suspended sediment indicate that the transparency of Benton Lake is influenced by both algae and suspended sediment. A greenish-brown water color was observed and minimal to large amounts of algae and slight to moderate amounts of suspended sediment were noted. Algal colonies were reported on two sampling dates. The lake is treated with copper sulfate for algal control.

Relationship to Lake Use

Secchi disc transparency may indicate the potential of the lake for exhibiting water quality and use impairment problems. It may also help a fisherman locate the most likely fish habitat.

Generally, from the surface to between two and five times the Secchi disc depth can be considered the euphotic (lighted) zone of the lake; in this region there is enough light to allow plants to survive and produce oxygen by photosynthesis. This is also the zone of greatest fish activity. Waters below the euphotic zone can be expected to have little or no dissolved oxygen during the summer if the lake is thermally stratified (has layers of water of different temperatures). During this stratification period, fish will probably be limited to the euphotic or aerobic (oxygenated) zone of the lake.

The lower limit of the euphotic zone of Benton Lake (estimated at twice the Secchi depth) ranged from 3.0-5.7 feet at Site 1, 3.5-7.0 feet at Site 2, and 2.5-5.0 feet at Site 3. Since Sites 1 and 2 are deep enough to thermally stratify and had a euphotic zone that was generally less than the total depth, low dissolved oxygen values would be expected in the bottom waters. Site 3 is so shallow that its bottom waters probably remain oxygenated due to mixing from wind.

In the absence of dissolved oxygen, substances such as hydrogen sulfide, ammonia, methane, phosphorus, iron, and manganese may accumulate in the bottom waters. When these substances are distributed throughout the lakes during mixing periods, they can trigger nuisance algal blooms, aquatic weed growth, and other water quality problems.

SUMMARY AND RECOMMENDATIONS

Summary

Benton Lake, a small, shallow recreational lake in southern Illinois, was sampled for seven dates between May 1 and October 31, 1981 under the Illinois EPA's Volunteer Lake Monitoring Program. Volunteer Leonard Hopkins recorded Secchi disc transparency, total depth, and field observations at three sites and reported results to the Illinois EPA.

The average Secchi disc transparency of Benton Lake (26.7 inches) ranked 50th of the 87 lakes monitored by volunteers in 1981 (rank 1 is clearest; 87 is least transparent). This average transparency was slightly less than the four feet minimum recommended for swimming by the Department of Public Health, but was in the normal range for Illinois lakes and compatible with most recreational uses.

Benton Lake is deep enough to thermally stratify during the summer. Since the lower limit of its euphotic zone (estimated at twice the Secchi depth) is generally less than the total depth, low bottom water dissolved oxygen values, associated water quality problems, and limitation of fish habitat may be expected during summer stratification.

Benton Lake is undergoing the process of eutrophication, as evidenced by transparency readings and field observations of algae, weed, and sediment problems. Protection from further degradation is critical. If nutrient and sediment input were controlled, lake quality would probably improve; failure to control inputs will probably result in continued rapid eutrophication. Lake managers should identify sources of nutrient and sediment input and take steps to control them before the lake becomes further degraded.

Recommendations

Developing a management plan for a lake requires a comprehensive assessment of the lake and watershed and is beyond the scope of this project. However, some suggestions regarding lake management are presented below for consideration; their applicability to this lake would require further study. Alternative options not presented here may also apply.

Installation of Resource Management Systems in source areas of the watershed may reduce nutrient and sediment transport to the lake. Stabilization of portions of the lake shoreline by riprap or some other means may also reduce sediment input. Nutrient contributions from septic tanks, fertilization of lawns, and waterfowl should also be investigated and minimized.

In-lake management may also warrant consideration. Aeration-destratification to prevent dissolved oxygen depletion may promote a shift in algal populations to species other than the problem causing blue-greens, reduce the need for copper sulfate, and improve fishing. Harvesting of aquatic weeds or use of screens might be considered.

Continued monitoring is recommended for Benton Lake. Consistent data gathered over a period of years is necessary to more fully document water quality trends, identify problems, and evaluate lake/watershed management strategies.

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DS:jab/sp2161c

GLOSSARY*

acre-foot - the volume of water required to cover one acre to a depth of one foot and equal to 0.3258 million gallons; a unit of storage capacity obtained by multiplying surface area (in acres) by average depth (in feet).

aeration-destratification - the addition of air to the water through mechanical means to increase the dissolved oxygen content of the bottom waters of lakes by eliminating thermal stratification and homogenizing the entire water column.

aerobic - conditions characterized by the presence of oxygen.

algae - one-celled or colonial photosynthetic plants (usually microscopic), found suspended in water or attached to damp rocks or other substrates.

algal bloom - a large number of planktonic algae, which often turns the water green and may produce objectionable scums and odors; a condition in which algae cloud the water noticeably.

ambient - existing condition or level at the time and place.

ammonia - a colorless, gaseous, alkaline compound which is a decompositional end product of nitrogen-containing organic matter; its importance in fresh water is associated with its toxicity to aquatic organisms and its use as a nutrient for aquatic plant growth.

anaerobic - conditions characterized by the absence of oxygen.

anoxic - without oxygen.

aquatic - growing or living in water; pertaining to water.

aquatic weeds - larger plants easily visible to the naked eye which are submergent, floating or emergent in the water.

artificial - man-made; constructed.

average depth - mean depth of a lake, calculated by dividing the volume (storage capacity) by the surface area.

backwater (or river backwater) - water impoundment located along the side of a stream or river which may flood periodically or have a direct connection to the stream at all times.

blue-green algae - a group of one celled or colonial plants of the phylum Cyanophyta, which live in water or damp places and reflect a blue to dark green tint; most often responsible for nuisance algal blooms with scum and odors.

borrow pit - a water impoundment formed by removal of earth for fill construction in the making of roads, dikes, bridges and levees

bottomland lake - natural water impoundment located in a river floodplain

circulation period - mixing period for a lake; period of time in which the entire lake volume is not thermally stratified and is totally mixed by wind action.

condition - the overall quality of the lake for supporting general use

detritus - finely divided organic and inorganic settleable material suspended in the water

diatoms - a group of one-celled or colonial algae living in water or damp places which are characterized by the presence of yellow-green or brown pigments and cell walls which contain silica and are composed of two halves (valves), one overlapping the other like the top and bottom of a pill box

drainage area - watershed; the land surface surrounding the lake which contributes water via surface runoff to the lake

ecology - the study of the relationship of organisms to their environment

emergent - a rooted aquatic plant with parts normally extending above the water surface

epilimnion - upper, relatively warm, circulating zone of water in a thermally stratified lake

euphotic zone - region of a lake where light penetration is sufficient to maintain photosynthesis; its lower limit is generally two to five times the Secchi disc transparency.

eutrophic - waters which are rich in plant nutrients and capable of supporting high biological productivity; USEPA defines a eutrophic lake as one that exhibits any of the following characteristics: biomass accumulations of primary producers (algal blooms and excessive aquatic weeds); rapid organic or inorganic sedimentation and shallowing; or seasonal dissolved oxygen deficiencies in the bottom waters and subsequent shift in species composition of aquatic fauna to forms that can tolerate lower concentrations of oxygen.

eutrophication - lake aging through nutrient enrichment and sedimentation.

fertile - waters rich in plant nutrients.

glacial lake - body of standing water formed by glacial action.

green algae - a group of one-celled or colonial plants of the phylum Chlorophyta, which live in water or damp areas and reflect a greenish tint.

hydrogen sulfide - a gaseous compound produced under anaerobic conditions which has a rotten egg smell.

hypolimnion - lower, relatively cold, noncirculating zone in a thermally stratified lake.

impairment - that which damages or negatively impacts the present or potential use of a body of water.

impoundment - a body of standing water constructed by artificial means or formed by nature.

in-lake treatment or control techniques - methods to limit the availability of pollutants already in the lake or to accelerate their outflow; and various physical, chemical and biological approaches for managing the consequences of degradation and enhancing the usability of the lake without controlling the source of the degradation.

iron - an essential micronutrient, which is considered objectionable in water supplies because it can cause taste and odor problems and stain laundry.

lake - a body of standing water 6.0 acres or more in surface area (as defined by the Illinois Department of Conservation).

lake code - an eight-digit combination of letters and numbers used to identify a lake in the computer.

limnologist - aquatic ecologist; one who studies the physical, chemical, and biological aspects of lakes.

limnology - the study of the ecology of inland lakes.

littoral - shoreward region of a body of water.

macrophyte - large plant of macroscopic size (easily visible to the naked eye).

management - non-structural measures designed to enhance the quality and usability of a lake.

manganese - an essential micronutrient, which is considered objectionable at high concentrations because it can cause taste and odor problems.

maximum (max) - highest (largest) value observed in a data set.

maximum depth - depth of deepest point in a lake.

mean - a statistical term for average, calculated by totalling the values and dividing by the number of observations.

mean depth - the volume of a lake divided by its surface area; average depth.

mesotrophic - waters intermediate in character between oligotrophic and eutrophic; moderately well supplied with plant nutrients and capable of supporting moderate biological productivity.

minimum (min) - smallest (lowest) value observed in a data set.

mixing period - circulation period of a lake; period of time in which the lake is not thermally stratified and is totally mixed by wind action.

nitrogen - an element which is an essential plant nutrient and is one of the principal elemental constituents of proteins.

nonpoint pollution - pollution from diffuse sources (e.g., agriculture, forestry operations, mining, construction) for which a specific point of discharge cannot be readily identified.

nutrient - any chemical element, ion or compound that is required by an organism for the continuation of growth, reproduction and other life processes; nitrogen and phosphorus are usually growth limiting factors for aquatic plants.

oligotrophic - waters with low concentrations of plant nutrients and hence capable of supporting little biological productivity.

organizational impoundment - body of standing water owned, leased or maintained by an organization of six or more members (as defined by the Illinois Department of Conservation).

phosphorus - an element which is an essential plant nutrient and plays a vital role in the energy transfer during cell metabolism.

photosynthesis - the process by which green plants use the sun's energy to convert dioxide and water into chemical energy (carbohydrates, fats, and proteins).

phytoplankton - microscopic plants (algae) that drift passively in open water regions of lakes and rivers.

plankton - the community of microscopic plants and animals that drift passively in open water regions of lakes and rivers.

point source pollution - pollution emanating from a discharge point such as a pipe which can be specifically identified (e.g., sewage treatment plants, manufacturing plants).

pollution - any substance which makes another unclean or impure.

pond - small body of standing water less than 6.0 acres in surface area (as defined by the Illinois Department of Conservation).

potable - of quality for drinking.

private impoundment - body of standing water privately owned or leased with no fee charged for use (as defined by the Illinois Department of Conservation).

production - total amount of living matter produced in a lake per unit time.

productivity - rate at which organic material (and energy) is produced and transferred through organisms in an ecosystem; standing crop of organisms that can be supported.

protection - pollution abatement or control; measures to prevent pollution from entering a lake, including methods to stop the pollution at its source or to treat it before it reaches the lake.

public access - publicly owned contiguous land or easements providing any member of the public the same or equivalent opportunity to enjoy privileges and benefits of the lake as any other member of the public or as any resident around the lake.

public impoundment - body of standing water owned and maintained by a governmental agency (excluding the Illinois Department of Conservation) that have public access.

public water supply - used as a municipal water supply for domestic needs.

Resource Management Systems - best management practices for the control and abatement of nonpoint pollution; a combination of agricultural practices which reduce soil erosion and/or increase water retention.

restoration - structural measures designed to return a lake to its original condition (e.g., dredging to original depth).

reservoir - a watershed impoundment artificially constructed by damming of a stream.

resuspend - cause to be suspended in the water.

river basin - drainage area for a large river.

seasonal - over a period of time (seasonal).

Secchi disc - an eight-inch diameter weighted metal plate painted black and white in alternating quadrants which is lowered into the water on a calibrated line to measure the transparency or clarity of the water.

Secchi disc depth - the depth into the water to which a black and white circular disc can be seen when viewed from the surface; a measure of water transparency or its ability to allow vertical light penetration.

sediment - the solid materials (particulate matter) transported by, suspended in or deposited from, water; includes fragmentary material that originates from weathering of rock, chemical and biochemical precipitants and decomposed organic material such as humus.

sediment-related turbidity - muddiness; cloudiness or opaqueness of the water caused by suspended sediment.

sedimentation - deposition of organic and/or inorganic particulate matter.

sedimentation surveys - measurement of the amount of sediment deposited in a water body.

segments - a subwatershed within a large river basin.

spatial - differences over an area.

standard deviation (Std. Dev.) - a statistical term to describe the variability of the data around the mean (average); if the magnitude of the standard deviation is "small" relative to the mean, then most of the values are close to the mean in magnitude and the data has little variability (is relative uniform); if the standard deviation is large in magnitude relative to the mean, then the data is more variable.

state impoundment - a body of standing water owned or leased and maintained by the Illinois Department of Conservation.

storage capacity - volume of water an impoundment can hold; often expressed in acre-feet, million gallons, and cubic meters.

submergent - an aquatic plant that lives and grows entirely below the surface of the water.

succession - in ecology, the progressive change of plant and animal life in an area.

suspended sediment - the sediment that at any given time is maintained in suspension by current or as a colloid.

suspended solids - particulate material that at any given time is maintained in suspension by current or as a colloid; total suspended solids are all suspended particular material, volatile and non-volatile, organic and inorganic; volatile suspended solids is that suspended particulate material, generally organic in nature, which undergoes combustion at a temperature of 600°C.

suspension - a heterogenous mixture in which the particles of one substance are kept dispersed by agitation.

thermal stratification - the layering of the water in a lake due to different densities as a function of temperature; the layers are the epilimnion (upper), metalimnion or thermocline (middle), and the hypolimnion (lower).

thermocline - metalimnion; the middle layer of water in a thermally stratified lake in which temperature decreases rapidly with increasing depth.

transparency - ability to allow light penetration and be seen through; clarity.

trophic state - the degree of eutrophication of a lake; the rate of primary biological production it is capable of supporting.

turbid - cloudy, opaque, murky, dirty-looking; containing suspensoids (organic or inorganic) which interfere with light penetration.

turbidity - amount of scattering of light caused by material suspended in the water.

use impairment - that which damages or negatively impacts the present or potential use of a body of water.

water quality - the suitability of the water for supporting various uses.

water retention time - water residence time; period of time a mass of water remains in an impoundment.

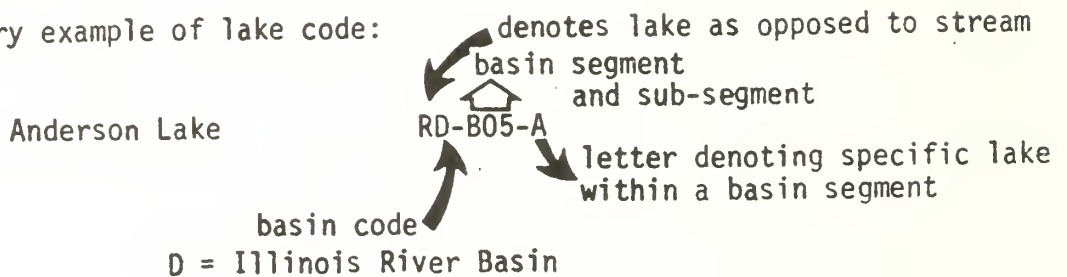
watershed - drainage area; the land surface surrounding the lake which contributes water, via surface runoff, to the lake; the total or contributing watershed area is the total draining to the lake, including the lake surface area; the immediate or net watershed is the portion of the total watershed (free of lakes or sloughs) from which direct, unimpeded surficial runoff drains to the lake.

zooplankton - animal portion of the community of suspended or floating organisms which drift passively with the water currents.

ABBREVIATIONS AND SYMBOLS

av - average
brn - brown
brnsh-grn - brownish-green
grn-brn - green-brown
grnsh-brn - greenish-brown
lt - light
max - maximum value
min - minimum value
mod - moderately
std. dev. - standard deviation
v - very

Explanatory example of lake code:



*Definitions of items in sense used in text

DS:sp,6207a,1-8

UNIVERSITY OF ILLINOIS-URBANA
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VOLUNTEER LAKE MONITORING PROGRAM SPRIN
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Cup. 2

Nat. Hist. Surv.

ILLINOIS ENVIRONMENTAL PROTECTION AGENCY
DIVISION OF WATER POLLUTION CONTROL
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1981 VOLUNTEER LAKE

NATURAL HISTORY

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MONITORING PROGRAM REPORT



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1981 VOLUNTEER LAKE MONITORING PROGRAM REPORT
FOR
BASS LAKE, LEE COUNTY, ILLINOIS

A Cooperative Citizen -
Illinois Environmental Protection Agency
Project

May, 1982
Illinois Environmental Protection Agency
2200 Churchill Road
Springfield, Illinois 62706

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INTRODUCTION

A cooperative volunteer lake monitoring effort was initiated by the Illinois EPA in 1981 as part of an overall self-help, service program being developed for lakes. In addition to expanding the Agency's lakes data base with information on present water quality and trends, the program was designed to involve citizens in learning about a lake so they could make more informed decisions regarding its use, protection, and enhancement.

Citizens selected a lake they were concerned about and were trained to measure water clarity or transparency by recording the depth to which a Secchi disc (an eight-inch diameter metal plate painted black and white in alternating quadrants) was visible. They also measured total depth and recorded field observations from a boat at three sites on their chosen lake. Readings were to be taken twice a month from May through October and reported to the Agency on special data forms. The Secchi disc, data forms, and postage paid envelopes were provided by the Agency. Volunteers were required to have a boat with an anchor to perform the monitoring.

Approximately 140 volunteers participated in monitoring 87 lakes in 1981. The sampling data were computerized to facilitate analyses and preparation of tables and graphs for reports. A statewide report entitled "Volunteer Lake Monitoring, 1981", summarized all the data for the volunteer lakes. Individual reports were also prepared for each of the 87 lakes monitored by volunteers in 1981.

BACKGROUND

Bass Lake is a 26 acre impoundment located 5 miles northwest of Sublette in Lee County, Illinois. It is owned by the Woodhaven Association. The lake, which was constructed by damming an unnamed stream, has a maximum depth of 14 feet, an average depth of 10 feet and a storage capacity of 270 acre-feet (Table 1).

Bass Lake serves as a recreational lake used primarily for fishing. Access is limited to organization members and their guests only.

The watershed drainage area of Bass Lake is estimated to be 50% residential. The lake shoreline is also primarily residential.

Deposition of sediment is considered a substantial problem for Bass Lake, while suspended sediment and aquatic weeds are considered moderate problems. Pasture or grassland runoff, cropland runoff, and sediment in the lake are cited as potential pollution sources.

Assessment and monitoring information on Bass Lake was provided by Lisa Brooks, Aquatic Biologist. Secchi disc depth, total depth, and field observations were recorded at three sites (located in Figure 1) on ten dates in 1981.

TABLE 1. LAKE ASSESSMENT SUMMARY, BASS LAKE, LEE COUNTY, ILLINOIS (RP-A06-J).

I. GENERAL INFORMATION

River Basin: Rock
Segment: A06

Ownership: L.E. Lueder, Sr.-Gen.Mgr.-
Woodhaven Assoc.

Surface Area (Acres): 25.77
Watershed Area (Acres):
Maximum Depth (Feet): 14
Average Depth (Feet): 10
Storage Capacity (Acre/Feet): 270
Inflowing Stream(s):
Outflowing Stream(s):
Water Retention Time:
Lake Type: dammed stream
Year Constructed:

II. USAGE

Public Access: no
Lake Usage:
Potable Water Supply: none
Industrial Water Supply: none
Agricultural Water Supply: none
Cooling Water: none
Recreation:
Fishing: very heavy
Swimming: none
Power Boating: none
Row Boating or Canoeing: moderate
Sailboating: light
Camping: none
Picnicking: none
Waterfowl Hunting: none
Waterfowl Observation: light
Other:

Recreational Facilities:
none

Shoreline Usage (Percent):

Urban (Including Streets): 5%
Residential (Including Lawns): 90%
Golf Courses:
Pasture or Grassland:
Woodland: 5%
Row Crops:
Wetland:
Other:

Watershed Usage (Percent):

Urban:
Residential: 50%
Golf Courses:
Pasture or Grassland: 5%
Woodland: 2%
Row Crops: 43%
Wetland:
Other:

III. WATER QUALITY AND PROBLEMS

General Water Quality: fair
Fishing: good
Conditions and Extent:
Suspended Sediment: moderate
Deposition of Sediment: large
Algal Blooms: minimal
Aquatic Weeds: moderate
Taste and/or Odor: minimal
Water Level Fluctuation: minimal
Fishkills: minimal
Other:

IV. CAUSES OF WATER QUALITY PROBLEMS

Potential Pollution Sources:

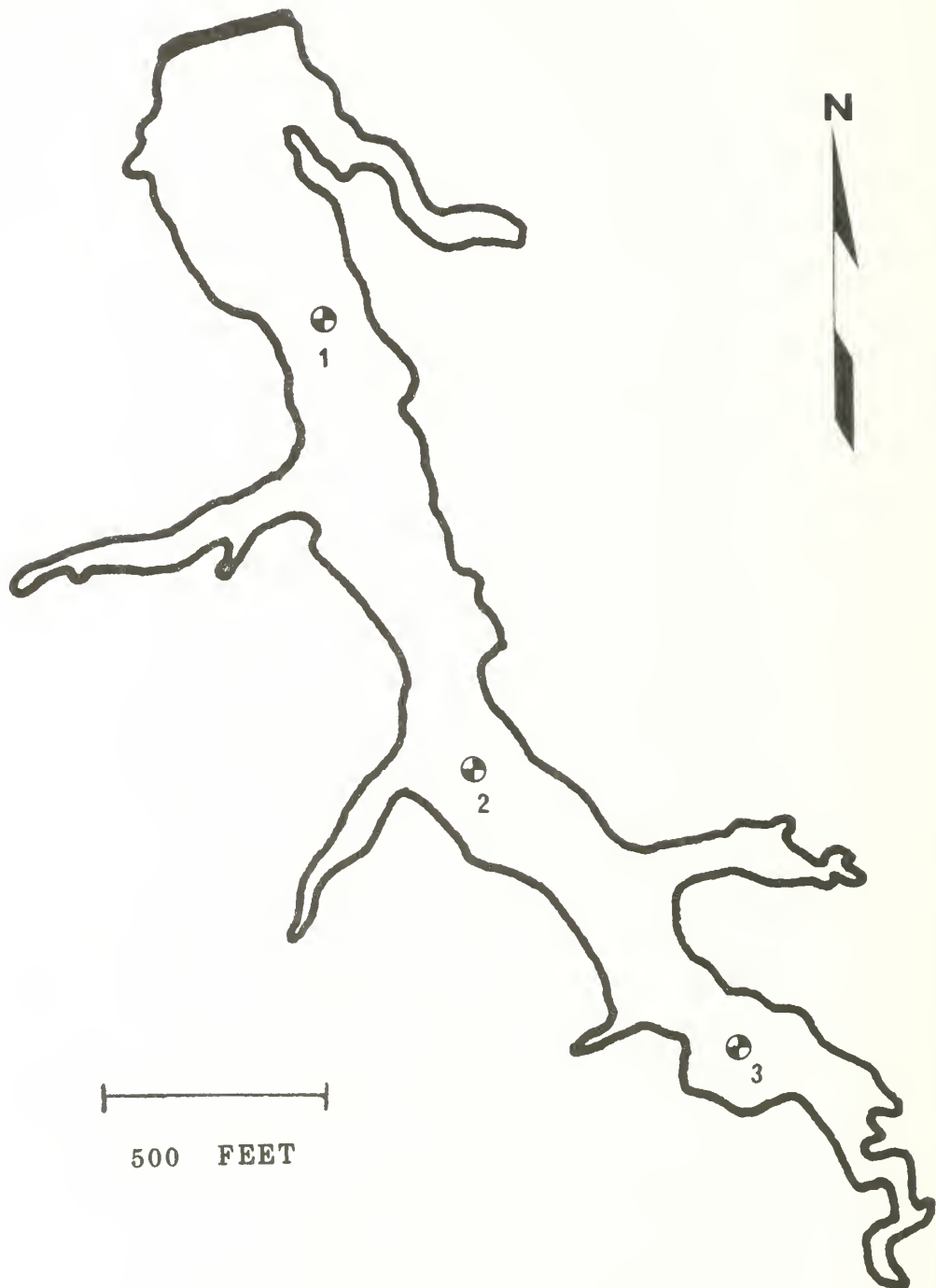
Sewage Treatment Plant Effluent:
Industrial Discharge:
Urban Storm Drainage:
Septic Tanks:
Pasture or Grassland Runoff: yes
Cropland Runoff: yes
Feedlot Runoff:
Construction Site Runoff:
Fertilizer or Pesticides from
Lawns/Golf Courses:
Orchards:
Forestry Operations Runoff:
Mining:
Waterfowl:
Sediment in Lake: yes
Other:

V. LAKE MANAGEMENT

Comments: Fall 1979-Aerator installed; 6/80 Diquat
to control filamentous algae along shore; 6/81 -
Rotenone to eliminate excess green sunfish; Summer 1981
mechanical weed harvesting & stocking with largemouth
Bass. Retention/fish rearing pond to be constructed at
south stream entrance in Spring 1982.

Information Supplied By Lisa Brooks (1981)

FIGURE 1
BASS LAKE
LEE COUNTY



RESULTS AND DISCUSSION

In this section, monitoring results will be presented for the lake and compared to those for other lakes in the volunteer program. Then spatial (within lake) and seasonal differences in transparency will be examined and related to field observations. Results will also be discussed in terms of lake uses. For an explanation of unfamiliar terms or concepts presented here, refer to the report "Volunteer Lake Monitoring, 1981", Section IV "Understanding Illinois' Lakes."

The Secchi monitoring data for Bass Lake are summarized in Table 2 and plotted in Figure 2. Total depth data are provided in Table 3, while field observations are summarized in Table 4.

Transparency of Bass Lake

The average Secchi disc transparency of Bass Lake was 42.6 inches, which ranked number 37 when the average transparencies of volunteer lakes were ranked from clearest (number 1 at 137.8 inches). This average transparency was less than the four feet minimum recommended for swimming by the Illinois Department of Public Health (1976). However, it was in the normal range for Illinois lakes and was compatible with most recreational uses.

Spatial and Seasonal Differences in Transparency

The Secchi disc transparency of Bass Lake ranged from a minimum of 6 inches at Site 1 on June 30 to a maximum of 102 inches at Site 1 on October 29. Secchi readings were below the four feet minimum recommended for swimming on five of the ten sampling dates at Sites 1 and 2 and on all dates but one at Site 3.

The clarity of Sites 1 and 2 on Bass Lake were similar, while it was lower at Site 3. Average transparencies were 49.5 inches, 48.0 inches and 30.2 inches at Sites 1, 2, and 3, respectively. The lower transparencies at Site 3 were probably related, in part, to its shallow depth ($x = 4.0$ feet), which allowed wind and wave activity to stir up the bottom sediment. It may also reflect the input of nutrients and sediment in the vicinity of Site 3.

There were seasonal differences in the transparency of Bass Lake. Lowest transparencies were generally recorded in midsummer and were the result of increased amounts of suspended sediment brought about by heavy rains which fell during this time.

Field observations indicate that the transparency of Bass Lake was influenced primarily by suspended sediment. A brown water color and moderate to large amounts of suspended sediment were observed on most of the sampling days. Aquatic weeds were noted as abundant along the shore and at Site 3. This probably reflects the shallow nature of these areas and/or nutrient input in the vicinity.

TABLE 2

SECCHI DISC TRANSPARENCY (INCHES) BASS/LEE COUNTY, ILLINOIS (VOLUNTEER DATA 1981)

DATE	SITE 1	SITE 2	SITE 3	MEAN	STD DEV
05/ 15	72.0	75.0	24.0	57.0	28.6
05/ 31	81.0	72.0	33.0	62.0	25.5
06/ 30	6.0	12.0	15.0	11.0	4.6
07/ 12	54.0	48.0	30.0	44.0	12.5
07/ 20	27.0	24.0	24.0	25.0	1.7
08/ 0	33.0	30.0	23.0	28.7	5.1
08/ 22	24.0	30.0	24.0	26.0	3.5
08/ 15	54.0	54.0	36.0	48.0	10.4
09/ 7	42.0	45.0	51.0	46.0	4.6
10/ 20	102.0	90.0	42.0	78.0	31.7

SUMMARY STATISTICS

LAKE

SITES

MEAN	49.5	48.0	30.2	42.6
STD DEV	29.2	25.0	10.6	23.0
MIN	6.0	12.0	15.0	6.0
MAX	102.0	90.0	51.0	102.0
AV DEPTH	10.9	9.0	6.8	

-1 = missing value

See glossary for explanation of Summary Statistics.

TABLE 3

DEPTH OF SITE (FEET) BASS/LEE COUNTY, ILLINOIS (VOLUNTEER DATA 1981)

DATE	SITE 1	SITE 2	SITE 3	MEAN	STD DEV
05/ 15	11.0	8.0	2.5	7.2	4.3
05/ 31	11.5	8.0	4.0	7.8	3.8
06/ 30	0.0	10.0	30.0	16.3	11.8
07/ 12	10.5	0.0	4.0	7.8	3.4
07/ 20	10.0	0.5	3.5	7.3	3.4
08/ 0	14.0	0.5	4.5	9.3	4.8
08/ 22	10.0	0.0	5.0	8.0	2.6
09/ 15	11.0	10.0	6.0	9.0	2.6
10/ 7	10.0	0.0	5.0	8.0	2.6
10/ 20	12.0	0.0	3.5	8.2	4.3

SUMMARY STATISTICS

LAKE

SITES

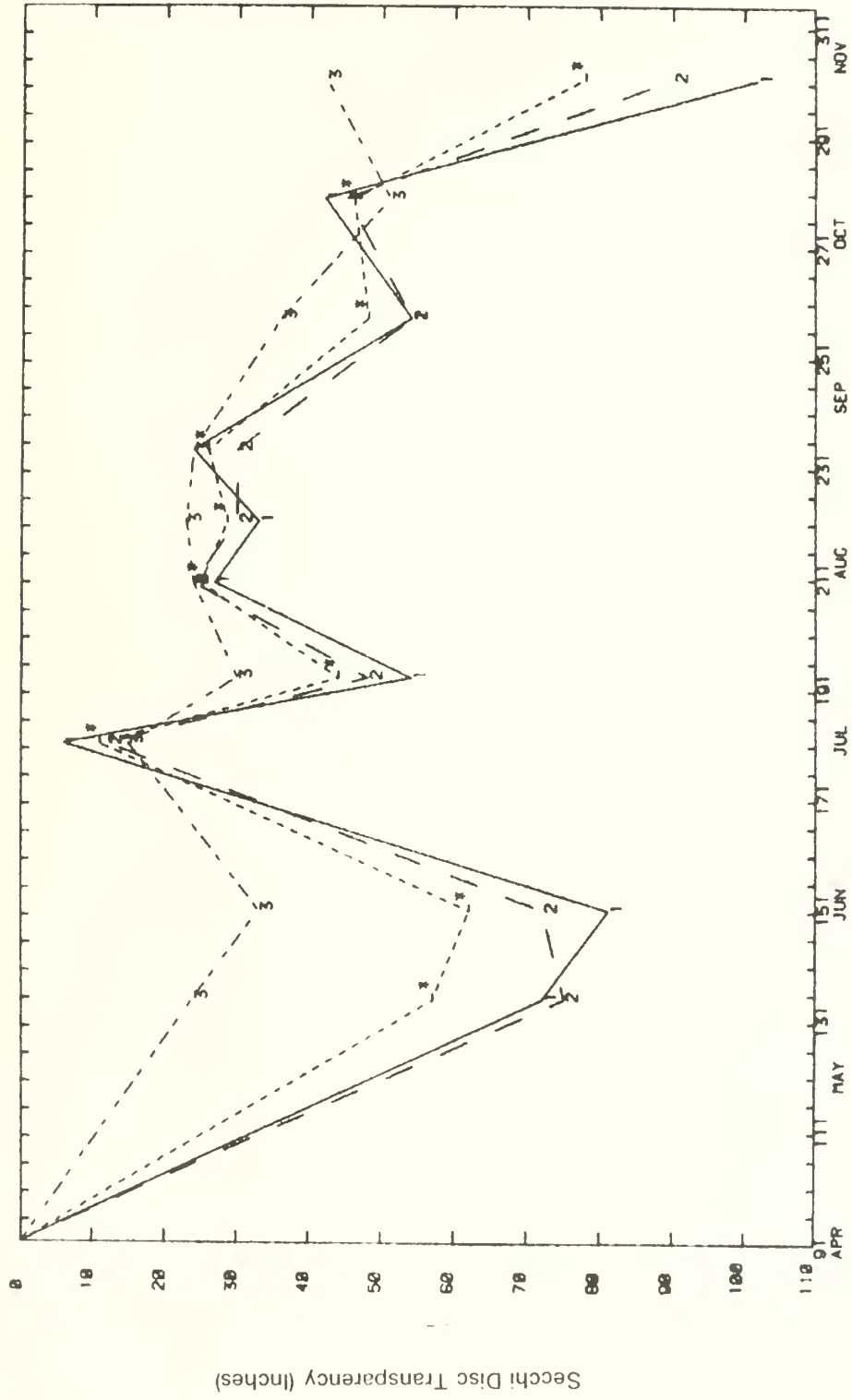
MEAN	10.0	0.0	6.0	8.0
STD DEV	1.4	0.7	8.2	5.0
MIN	0.0	0.0	2.5	2.5
MAX	14.0	10.0	30.0	30.0
AV DEPTH	10.0	0.0	6.8	

-1 = missing value

See glossary for explanation of Summary Statistics.

FIGURE 2

SECCHI DISC TRANSPARENCY (INCHES) BASS/LEE COUNTY, ILLINOIS (VOLUNTEER DATA 1981)



Day of Year

KEY

- 1 Site 1
- 2 Site 2
- 3 Site 3
- . Mean (Average)

TABLE 4. FIELD OBSERVATIONS, BASS LAKE, LEE COUNTY, ILLINOIS.

DATE	OBSERVATION	SITE 1	SITE 2	SITE 3	WEATHER AT LAKE	PRESENT	PRECEDING 24 HOURS	OTHER COMMENTS
5/15/81	WATER COLOR: SEDIMENT: ALGAE: WEEDS AT SAMPLE SITE: WEEDS NEAR SHORE: OTHER SUBSTANCES: ODOR:	mod. green moderate slight minimal slight none no odor	mod. green moderate slight minimal slight none no odor	brnsh-grn moderate slight large large algal mats musty	CLOUD COVER: PRECIPITATION: WAVES: AIR TEMPERATURE: WIND DIRECTION: OBSERVATIONS MADE BY:	few clouds no rain calm warm N Lisa Brooks	many clouds heavy rain small cool	WATER LEVEL OF LAKE: RECREATIONAL USAGE: LAKE MANAGEMENT: ADDITIONAL COMMENTS:
5/31/81	WATER COLOR: SEDIMENT: ALGAE: WEEDS AT SAMPLE SITE: WEEDS NEAR SHORE: OTHER SUBSTANCES: ODOR:	mod. green minimal slight minimal slight no odor no odor	grnsh-brn minimal slight minimal slight no odor no odor	grnsh-brn minimal moderate large large detritus musty	CLOUD COVER: PRECIPITATION: WAVES: AIR TEMPERATURE: WIND DIRECTION: OBSERVATIONS MADE BY:	clear no rain calm warm SW Lisa Brooks	clear no rain calm cool	WATER LEVEL OF LAKE: RECREATIONAL USAGE: LAKE MANAGEMENT: ADDITIONAL COMMENTS:
6/30/81	WATER COLOR: SEDIMENT: ALGAE: WEEDS AT SAMPLE SITE: WEEDS NEAR SHORE: OTHER SUBSTANCES: ODOR:	mod. brown large minimal minimal slight none no odor	mod. brown large minimal minimal slight none no odor	mod. brown large minimal moderate large none no odor	CLOUD COVER: PRECIPITATION: WAVES: AIR TEMPERATURE: WIND DIRECTION: OBSERVATIONS MADE BY:	overcast no rain calm warm Lisa Brooks	overcast no rain calm warm	WATER LEVEL OF LAKE: RECREATIONAL USAGE: LAKE MANAGEMENT: ADDITIONAL COMMENTS:
7/12/81	WATER COLOR: SEDIMENT: ALGAE: WEEDS AT SAMPLE SITE: WEEDS NEAR SHORE: OTHER SUBSTANCES: ODOR:	mod. green minimal moderate minimal large none none	mod. green minimal moderate minimal large none none	mod. green minimal moderate large none none	CLOUD COVER: PRECIPITATION: WAVES: AIR TEMPERATURE: WIND DIRECTION: OBSERVATIONS MADE BY:	clear no rain calm hot SE Lisa Brooks	clear no rain calm hot	WATER LEVEL OF LAKE: RECREATIONAL USAGE: LAKE MANAGEMENT: ADDITIONAL COMMENTS:

TABLE 4. FIELD OBSERVATIONS, BASS LAKE, LEE COUNTY, ILLINOIS.

DATE	OBSERVATION	SITE 1	SITE 2	SITE 3	WEATHER AT LAKE	PRESENT	PRECEDING 24 HOURS	OTHER COMMENTS
7/29/81	WATER COLOR: SEDIMENT: ALGAE: WEEDS AT SAMPLE SITE: WEEDS NEAR SHORE: OTHER SUBSTANCES: ODOR:	brnsh-grn moderate minimal large none no odor	brnsh-grn large minimal minimal large none no odor	brnsh-grn large minimal slight large none no odor	CLOUD COVER: PRECIPITATION: WAVES: AIR TEMPERATURE: WIND DIRECTION:	few clouds no rain calm warm	overcast lt. rain ripple cool	WATER LEVEL OF LAKE: RECREATIONAL USAGE: row boating/canoeing LAKE MANAGEMENT: 7/16 - 7/22 mechanical harvesting of algae ADDITIONAL COMMENTS:
					OBSERVATIONS MADE BY: Lisa Brooks			

DATE	OBSERVATION	SITE 1	SITE 2	SITE 3	WEATHER AT LAKE	PRESENT	PRECEDING 24 HOURS	OTHER COMMENTS
8/9/81	WATER COLOR: SEDIMENT: ALGAE: WEEDS AT SAMPLE SITE: WEEDS NEAR SHORE: OTHER SUBSTANCES: ODOR:	brnsh-grn large minimal minimal minimal none no odor	brnsh-grn large minimal minimal minimal none no odor	mod. brown large minimal minimal slight none no odor	CLOUD COVER: PRECIPITATION: WAVES: AIR TEMPERATURE: WIND DIRECTION:	clear no rain calm warm NE	overcast V. lt. rain ripple warm	WATER LEVEL OF LAKE: RECREATIONAL USAGE: row boating/canoeing LAKE MANAGEMENT: none ADDITIONAL COMMENTS:
					OBSERVATIONS MADE BY: Lisa Brooks			

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DATE	OBSERVATION	SITE 1	SITE 2	SITE 3	WEATHER AT LAKE	PRESENT	PRECEDING 24 HOURS	OTHER COMMENTS
8/22/81	WATER COLOR: SEDIMENT: ALGAE: WEEDS AT SAMPLE SITE: WEEDS NEAR SHORE: OTHER SUBSTANCES: ODOR:	mod. brown large minimal minimal moderate none no odor	mod. brown large minimal minimal moderate none no odor	very brown large minimal slight moderate none no odor	CLOUD COVER: PRECIPITATION: WAVES: AIR TEMPERATURE: WIND DIRECTION:	clear no rain calm warm NE	clear no rain calm warm	WATER LEVEL OF LAKE: RECREATIONAL USAGE: row boating/canoeing LAKE MANAGEMENT: none ADDITIONAL COMMENTS:
					OBSERVATIONS MADE BY: Lisa Brooks			

DATE	OBSERVATION	SITE 1	SITE 2	SITE 3	WEATHER AT LAKE	PRESENT	PRECEDING 24 HOURS	OTHER COMMENTS
9/15/81	WATER COLOR: SEDIMENT: ALGAE: WEEDS AT SAMPLE SITE: WEEDS NEAR SHORE: OTHER SUBSTANCES: ODOR:	brnsh-grn moderate minimal minimal large none no odor	brnsh-grn moderate minimal minimal large none no odor	brnsh-grn moderate minimal large large none no odor	CLOUD COVER: PRECIPITATION: WAVES: AIR TEMPERATURE: WIND DIRECTION:	clear no rain calm warm NW	few clouds no rain calm warm	WATER LEVEL OF LAKE: RECREATIONAL USAGE: normal fishing LAKE MANAGEMENT: none ADDITIONAL COMMENTS:
					OBSERVATIONS MADE BY: Lisa Brooks			

TABLE 4 FIELD OBSERVATIONS, BASS LAKE, LEE COUNTY, ILLINOIS.

DATE	OBSERVATION	SITE 1	SITE 2	SITE 3	WEATHER AT LAKE	PRESENT	PRECEDING 24 HOURS	OTHER COMMENTS
10/7/81	WATER COLOR: SEDIMENT: ALGAE: WEEDS AT SAMPLE SITE: WEEDS NEAR SHORE: OTHER SUBSTANCES: ODOR:	lt. brown large minimal minimal none no odor	lt. brown large minimal minimal minimal none no odor	brnsh-grn moderate minimal minimal minimal none no odor	CLOUD COVER: PRECIPITATION: WAVES: AIR TEMPERATURE: WIND DIRECTION: OBSERVATIONS MADE BY:	clear no rain ripple cool SE Lisa Brooks	many clouds V. lt. rain small cool	WATER LEVEL OF LAKE: RECREATIONAL USAGE: LAKE MANAGEMENT: ADDITIONAL COMMENTS:
10/29/81	WATER COLOR: SEDIMENT: ALGAE: WEEDS AT SAMPLE SITE: WEEDS NEAR SHORE: OTHER SUBSTANCES: ODOR:	grnsh-brn minimal minimal minimal none no odor	grnsh-brn minimal minimal minimal minimal none no odor	grnsh-brn minimal minimal minimal minimal none no odor	CLOUD COVER: PRECIPITATION: WAVES: AIR TEMPERATURE: WIND DIRECTION: OBSERVATIONS MADE BY:	clear no rain calm warm S.W. Lisa Brooks	clear no rain clam warm	WATER LEVEL OF LAKE: RECREATIONAL USAGE: LAKE MANAGEMENT: ADDITIONAL COMMENTS:
DATE	OBSERVATION	SITE 1	SITE 2	SITE 3	WEATHER AT LAKE	PRESENT	PRECEDING 24 HOURS	OTHER COMMENTS
	WATER COLOR: SEDIMENT: ALGAE: WEEDS AT SAMPLE SITE: WEEDS NEAR SHORE: OTHER SUBSTANCES: ODOR:				CLOUD COVER: PRECIPITATION: WAVES: AIR TEMPERATURE: WIND DIRECTION: OBSERVATIONS MADE BY:			WATER LEVEL OF LAKE: RECREATIONAL USAGE: LAKE MANAGEMENT: ADDITIONAL COMMENTS:
DATE	OBSERVATION	SITE 1	SITE 2	SITE 3	WEATHER AT LAKE	PRESENT	PRECEDING 24 HOURS	OTHER COMMENTS
	WATER COLOR: SEDIMENT: ALGAE: WEEDS AT SAMPLE SITE: WEEDS NEAR SHORE: OTHER SUBSTANCES: ODOR:				CLOUD COVER: PRECIPITATION: WAVES: AIR TEMPERATURE: WIND DIRECTION: OBSERVATIONS MADE BY:			WATER LEVEL OF LAKE: RECREATIONAL USAGE: LAKE MANAGEMENT: ADDITIONAL COMMENTS:
DATE	OBSERVATION	SITE 1	SITE 2	SITE 3	WEATHER AT LAKE	PRESENT	PRECEDING 24 HOURS	OTHER COMMENTS
	WATER COLOR: SEDIMENT: ALGAE: WEEDS AT SAMPLE SITE: WEEDS NEAR SHORE: OTHER SUBSTANCES: ODOR:				CLOUD COVER: PRECIPITATION: WAVES: AIR TEMPERATURE: WIND DIRECTION: OBSERVATIONS MADE BY:			WATER LEVEL OF LAKE: RECREATIONAL USAGE: LAKE MANAGEMENT: ADDITIONAL COMMENTS:

Relationship To Lake Use

Secchi disc transparency may indicate the potential of the lake for exhibiting water quality and use impairment problems. It may also help a fisherman locate the most likely fish habitat.

Generally, from the surface to between two and five times the Secchi disc depth can be considered the euphotic (lighted) zone of the lake; in this region there is enough light to allow plants to survive and produce oxygen by photosynthesis. This is also the zone of greatest fish activity. Waters below the euphotic zone can be expected to have little or no dissolved oxygen during the summer if the lake is thermally stratified (has layers of water of different temperatures). During this stratification period, fish will probably be limited to the euphotic or oxygenated zone of the lake.

The lower limit of the euphotic zone (estimated at twice the Secchi depth) of Bass Lake ranged from 1.0 - 17.0 feet at Site 1, from 2.0 - 15.0 feet at Site 2, from 2.5 - 8.5 feet at Site 3. Since Bass Lake is deep enough to thermally stratify and had a euphotic zone that was generally less than the total depth, low dissolved oxygen values would be expected in the bottom waters.

In the absence of dissolved oxygen, undesirable substances such as hydrogen sulfide, ammonia, methane, phosphorus, iron, and manganese accumulate in the bottom waters. When these substances are distributed throughout the lake during mixing periods, they can trigger nuisance algal blooms, aquatic weed growth, taste and odor, and other water quality problems.

SUMMARY AND RECOMMENDATIONS

Summary

Bass Lake a small, organizationally-owned recreational impoundment in northern Illinois, was sampled on 10 dates between May 1 and October 31, 1981 under the Illinois EPA's Volunteer Lake Monitoring Program. Volunteer Lisa Brooks recorded Secchi disc transparency, total depth, and field observations at three sites and reported results to the Illinois EPA.

The average Secchi disc transparency of Bass Lake (42.6 inches) ranked 37 of the 87 lakes monitored by volunteers in 1981 (rank 1 is clearest; 87 is least transparent). Although this average transparency was less than the four feet minimum recommended for swimming by the Department of Public Health, it was in the normal range for Illinois lakes and was compatible with most recreational uses.

Bass Lake is deep enough to thermally stratify during the summer. Since the lower limit of its euphotic zone (estimated at twice the Secchi depth) is generally less than the total depth, low bottom water dissolved oxygen values, associated water quality problems, and limitation of fish habitat may be expected during summer stratification.

Bass Lake is undergoing the process of eutrophication as evidenced by transparency readings and field observations of algae, weed, and sediment problems. Protection from further degradation is critical. If nutrient and sediment input were controlled, lake quality would probably improve; failure to control inputs will probably result in continued rapid eutrophication. Lake managers should identify sources of nutrient and sediment input and take steps to control them before the lake becomes further degraded.

Recommendations

Developing a management plan for a lake requires a comprehensive assessment of the lake and watershed and is beyond the scope of this project. However, some suggestions regarding lake management are presented below for consideration; their applicability to this lake would require further study. Alternative options not presented here may also apply.

Information on lake water levels is important for determining lake management strategies. Installation of a simple, but accurate, water level measuring device and frequent recording of lake water levels is recommended.

Lake managers should work with the Soil and Water Conservation District and the Soil Conservation Service to develop a procedure to identify and quantify non-point pollution source areas. This procedure should allow for the targeting of resources and programs to correct the identified problems.

Installation of Resource Management Systems in source areas of the watershed may reduce nutrient and sediment transport to the lake. Stabilization of the lake shoreline by riprap or some other means may also reduce sediment input. Nutrient contributions from septic tanks, fertilization of lawns, and waterfowl should also be investigated and minimized.

Continued in-lake management may also warrant consideration. Aeration-destratification to prevent dissolved oxygen depletion may improve fish habitat and fishing as well as prevent winterkill. Harvesting of nuisance aquatic weed is a recommended practice.

Continued monitoring is recommended for Bass Lake. Consistent data gathered over a period of years is necessary to document and evaluate water quality trends, identify problems, and evaluate lake/watershed management strategies.

REFERENCES

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Illinois Department of Public Health. 1976. The Minimum Sanitary Requirements for the Design and Operation of Swimming Pools and Bathing Beaches. State of Illinois, Department of Public Health, Springfield, Illinois.

Illinois Environmental Protection Agency. 1982. Volunteer Lake Monitoring, 1981. A Cooperative Citizen - Illinois Environmental Protection Agency project. Monitoring Unit; Division of Water Pollution Control, Illinois EPA, Springfield, Illinois.

Illinois State Water Survey. 1924-1981. Lake Sedimentation Surveys. Hydrology Section, Illinois State Water Survey, Urbana, Illinois.

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GLOSSARY*

acre-foot - the volume of water required to cover one acre to a depth of one foot and equal to 0.3258 million gallons; a unit of storage capacity obtained by multiplying surface area (in acres) by average depth (in feet).

aeration-destratification - the addition of air to the water through mechanical means to increase the dissolved oxygen content of the bottom waters of lakes by eliminating thermal stratification and homogenizing the entire water column.

aerobic - conditions characterized by the presence of oxygen.

algae - one-celled or colonial photosynthetic plants (usually microscopic), found suspended in water or attached to damp rocks or other substrates.

algal bloom - a large number of planktonic algae, which often turns the water green and may produce objectionable scums and odors; a condition in which algae cloud the water noticeably.

ambient - existing condition or level at the time and place.

ammonia - a colorless, gaseous, alkaline compound which is a decompositional end product of nitrogen-containing organic matter; its importance in fresh water is associated with its toxicity to aquatic organisms and its use as a nutrient for aquatic plant growth.

anaerobic - conditions characterized by the absence of oxygen.

anoxic - without oxygen.

aquatic - growing or living in water; pertaining to water.

aquatic weeds - larger plants easily visible to the naked eye which are submergent, floating or emergent in the water.

artificial - man-made; constructed.

average depth - mean depth of a lake, calculated by dividing the volume (storage capacity) by the surface area.

backwater (or river backwater) - water impoundment located along the side of a stream or river which may flood periodically or have a direct connection to the stream at all times.

blue-green algae - a group of one celled or colonial plants of the phylum Cyanophyta, which live in water or damp places and reflect a blue to dark green tint; most often responsible for nuisance algal blooms with scum and odors.

borrow pit - a water impoundment formed by removal of earth for fill construction in the making of roads, dikes, bridges and levees

bottomland lake - natural water impoundment located in a river floodplain

circulation period - mixing period for a lake; period of time in which the entire lake volume is not thermally stratified and is totally mixed by wind action.

condition - the overall quality of the lake for supporting general use

detritus - finely divided organic and inorganic settleable material suspended in the water

diatoms - a group of one-celled or colonial algae living in water or damp places which are characterized by the presence of yellow-green or brown pigments and cell walls which contain silica and are composed of two halves (valves), one overlapping the other like the top and bottom of a pill box

drainage area - watershed; the land surface surrounding the lake which contributes water via surface runoff to the lake

ecology - the study of the relationship of organisms to their environment

emergent - a rooted aquatic plant with parts normally extending above the water surface

epilimnion - upper, relatively warm, circulating zone of water in a thermally stratified lake

euphotic zone - region of a lake where light penetration is sufficient to maintain photosynthesis; its lower limit is generally two to five times the Secchi disc transparency.

eutrophic - waters which are rich in plant nutrients and capable of supporting high biological productivity; USEPA defines a eutrophic lake as one that exhibits any of the following characteristics: biomass accumulations of primary producers (algal blooms and excessive aquatic weeds); rapid organic or inorganic sedimentation and shallowing; or seasonal dissolved oxygen deficiencies in the bottom waters and subsequent shift in species composition of aquatic fauna to forms that can tolerate lower concentrations of oxygen.

eutrophication - lake aging through nutrient enrichment and sedimentation.

fertile - waters rich in plant nutrients.

glacial lake - body of standing water formed by glacial action.

green algae - a group of one-celled or colonial plants of the phylum Chlorophyta, which live in water or damp areas and reflect a greenish tint.

hydrogen sulfide - a gaseous compound produced under anaerobic conditions which has a rotten egg smell.

hypolimnion - lower, relatively cold, noncirculating zone in a thermally stratified lake.

impairment - that which damages or negatively impacts the present or potential use of a body of water.

impoundment - a body of standing water constructed by artificial means or formed by nature.

in-lake treatment or control techniques - methods to limit the availability of pollutants already in the lake or to accelerate their outflow; and various physical, chemical and biological approaches for managing the consequences of degradation and enhancing the usability of the lake without controlling the source of the degradation.

iron - an essential micronutrient, which is considered objectionable in water supplies because it can cause taste and odor problems and stain laundry.

lake - a body of standing water 6.0 acres or more in surface area (as defined by the Illinois Department of Conservation).

lake code - an eight-digit combination of letters and numbers used to identify a lake in the computer.

limnologist - aquatic ecologist; one who studies the physical, chemical, and biological aspects of lakes.

limnology - the study of the ecology of inland lakes.

littoral - shoreward region of a body of water.

macrophyte - large plant of macroscopic size (easily visible to the naked eye).

management - non-structural measures designed to enhance the quality and usability of a lake.

manganese - an essential micronutrient, which is considered objectionable at high concentrations because it can cause taste and odor problems.

maximum (max) - highest (largest) value observed in a data set.

maximum depth - depth of deepest point in a lake.

mean - a statistical term for average, calculated by totalling the values and dividing by the number of observations.

mean depth - the volume of a lake divided by its surface area; average depth.

mesotrophic - waters intermediate in character between oligotrophic and eutrophic; moderately well supplied with plant nutrients and capable of supporting moderate biological productivity.

minimum (min) - smallest (lowest) value observed in a data set.

mixing period - circulation period of a lake; period of time in which the lake is not thermally stratified and is totally mixed by wind action.

nitrogen - an element which is an essential plant nutrient and is one of the principal elemental constituents of proteins.

nonpoint pollution - pollution from diffuse sources (e.g., agriculture, forestry operations, mining, construction) for which a specific point of discharge cannot be readily identified.

nutrient - any chemical element, ion or compound that is required by an organism for the continuation of growth, reproduction and other life processes; nitrogen and phosphorus are usually growth limiting factors for aquatic plants.

oligotrophic - waters with low concentrations of plant nutrients and hence capable of supporting little biological productivity.

organizational impoundment - body of standing water owned, leased or maintained by an organization of six or more members (as defined by the Illinois Department of Conservation).

phosphorus - an element which is an essential plant nutrient and plays a vital role in the energy transfer during cell metabolism.

photosynthesis - the process by which green plants use the sun's energy to convert dioxide and water into chemical energy (carbohydrates, fats, and proteins).

phytoplankton - microscopic plants (algae) that drift passively in open water regions of lakes and rivers.

plankton - the community of microscopic plants and animals that drift passively in open water regions of lakes and rivers.

point source pollution - pollution emanating from a discharge point such as a pipe which can be specifically identified (e.g., sewage treatment plants, manufacturing plants).

pollution - any substance which makes another unclean or impure.

pond - small body of standing water less than 6.0 acres in surface area (as defined by the Illinois Department of Conservation).

potable - of quality for drinking.

private impoundment - body of standing water privately owned or leased with no fee charged for use (as defined by the Illinois Department of Conservation).

production - total amount of living matter produced in a lake per unit time.

productivity - rate at which organic material (and energy) is produced and transferred through organisms in an ecosystem; standing crop of organisms that can be supported.

protection - pollution abatement or control; measures to prevent pollution from entering a lake, including methods to stop the pollution at its source or to treat it before it reaches the lake.

public access - publicly owned contiguous land or easements providing any member of the public the same or equivalent opportunity to enjoy privileges and benefits of the lake as any other member of the public or as any resident around the lake.

public impoundment - body of standing water owned and maintained by a governmental agency (excluding the Illinois Department of Conservation) that have public access.

public water supply - used as a municipal water supply for domestic needs.

Resource Management Systems - best management practices for the control and abatement of nonpoint pollution; a combination of agricultural practices which reduce soil erosion and/or increase water retention.

restoration - structural measures designed to return a lake to its original condition (e.g., dredging to original depth).

reservoir - a watershed impoundment artificially constructed by damming of a stream.

resuspend - cause to be suspended in the water.

river basin - drainage area for a large river.

seasonal - over a period of time (seasonal).

Secchi disc - an eight-inch diameter weighted metal plate painted black and white in alternating quadrants which is lowered into the water on a calibrated line to measure the transparency or clarity of the water.

Secchi disc depth - the depth into the water to which a black and white circular disc can be seen when viewed from the surface; a measure of water transparency or its ability to allow vertical light penetration.

sediment - the solid materials (particulate matter) transported by, suspended in or deposited from, water; includes fragmentary material that originates from weathering of rock, chemical and biochemical precipitants and decomposed organic material such as humus.

sediment-related turbidity - muddiness; cloudiness or opaqueness of the water caused by suspended sediment.

sedimentation - deposition of organic and/or inorganic particulate matter.

sedimentation surveys - measurement of the amount of sediment deposited in a water body.

segments - a subwatershed within a large river basin.

spatial - differences over an area.

standard deviation (Std. Dev.) - a statistical term to describe the variability of the data around the mean (average); if the magnitude of the standard deviation is "small" relative to the mean, then most of the values are close to the mean in magnitude and the data has little variability (is relative uniform); if the standard deviation is large in magnitude relative to the mean, then the data is more variable.

state impoundment - a body of standing water owned or leased and maintained by the Illinois Department of Conservation.

storage capacity - volume of water an impoundment can hold; often expressed in acre-feet, million gallons, and cubic meters.

submergent - an aquatic plant that lives and grows entirely below the surface of the water.

succession - in ecology, the progressive change of plant and animal life in an area.

suspended sediment - the sediment that at any given time is maintained in suspension by current or as a colloid.

suspended solids - particulate material that at any given time is maintained in suspension by current or as a colloid; total suspended solids are all suspended particular material, volatile and non-volatile, organic and inorganic; volatile suspended solids is that suspended particulate material, generally organic in nature, which undergoes combustion at a temperature of 6000C.

suspension - a heterogenous mixture in which the particles of one substance are kept dispersed by agitation.

thermal stratification - the layering of the water in a lake due to different densities as a function of temperature; the layers are the epilimnion (upper), metalimnion or thermocline (middle), and the hypolimnion (lower).

thermocline - metalimnion; the middle layer of water in a thermally stratified lake in which temperature decreases rapidly with increasing depth.

transparency - ability to allow light penetration and be seen through; clarity.

trophic state - the degree of eutrophication of a lake; the rate of primary biological production it is capable of supporting.

turbid - cloudy, opaque, murky, dirty-looking; containing suspensoids (organic or inorganic) which interfere with light penetration.

turbidity - amount of scattering of light caused by material suspended in the water.

use impairment - that which damages or negatively impacts the present or potential use of a body of water.

water quality - the suitability of the water for supporting various uses.

water retention time - water residence time; period of time a mass of water remains in an impoundment.

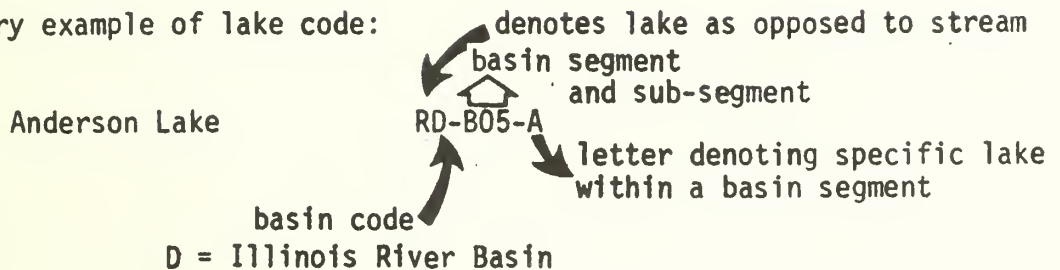
watershed - drainage area; the land surface surrounding the lake which contributes water, via surface runoff, to the lake; the total or contributing watershed area is the total draining to the lake, including the lake surface area; the immediate or net watershed is the portion of the total watershed (free of lakes or sloughs) from which direct, unimpeded surficial runoff drains to the lake.

zooplankton - animal portion of the community of suspended or floating organisms which drift passively with the water currents.

ABBREVIATIONS AND SYMBOLS

av - average
brn - brown
brnsh-grn - brownish-green
grn-brn - green-brown
grnsh-brn - greenish-brown
lt - light
max - maximum value
min - minimum value
mod - moderately
std. dev. - standard deviation
v - very

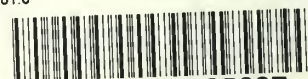
Explanatory example of lake code:



*Definitions of items in sense used in text

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VOLUNTEER LAKE MONITORING PROGRAM SPRIN
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